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THE ATLANTIC BLUEFIN TUNA: A PUBLIC POLICY APPROACH TO SAVING AN ICONIC SPECIES

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A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University.

by

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LIST OF ABBREVIATIONS

ABTE	Atlantic Bluefin Tuna Eastern Stock
ABTW	Atlantic Bluefin Tuna Western Stock
BFTE	Bluefin Tuna-Eastern Stock
CCAMLR	Commission for the Conservation of Atlantic Marine Living Resources
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
CITES	Convention on International Trade in Endangered Species
EEZ	Exclusive Economic Zone
ENA	Ecological Network Analysis
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FAO	United Nations Food and Agriculture Organization
IATTC	Inter-American Tropical Tuna Commission
ICCAT	International Commission for the Conservation of Atlantic Tunas
ICNAF	International Convention for the Northwest Atlantic Fisheries
IOTC	Indian Ocean Tuna Commission
IUU	Illegal, Unreported and Unregulated Fishing
IWC	International Whaling Commission
JPA	Japan Fisheries Association
MFCMA	Magnuson Fishery Conservation and Management Act of 1976
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act of 1996
MSY	Maximum Sustainable Yield
MT (mt)	Metric Tonnes
NMFS	National Marine Fisheries Service (United States)
NOAA	National Oceanographic and Atmospheric Administration (United States)
OFCF	Overseas Fisheries Cooperation Foundation
RMFO	Regional Fishery Management Organizations
SCRS	Standing Committee on Research and Statistics (ICCAT)
SDA	Secondary Data Analysis
SNA	Social Network Analysis
SSB	Spawning Stock Biomass
TAC	Total Allowable Catch
UNCLOS	United Nations Convention on the Law of the Sea
USCG	United States Coast Guard
USFWS	United States Fish and Wild Life Service
WPCFC	Western and Central Pacific Fisheries Commission
WWF	World Wildlife Fund

Abstract

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The Atlantic Bluefin Tuna (*Thunnus thynnus*) is perhaps the most magnificent and most marvelous nomadic wild animal living in the world. It lives in the deep blue waters of the Atlantic Ocean and is one of the largest of the world's fin fish and the largest of the 48 other species of tuna (Kuhn, 1996). It is a species that seems to have been designed and sculpted by an artist—sleek, smooth, and beautiful—instead of having been a product of an evolutionary process.

Today, the existence and future of the Atlantic Bluefin Tuna is in question because of the constant overexploitation of the stocks for its flesh. The insanely high prices being paid for its flesh have resulted in a modern day gold rush for almost any person who has the ability and equipment to catch it. The movements of the Atlantic Bluefin Tuna take it through multiple jurisdictional, national, and international boundaries, spending part of its life in areas of the

world's commons, also known as the high seas. In each, the species is managed through complex, often cloudy and poorly enforced state, regional, and national laws and international treaties. For decades the terms *overfished*, *under pressure*, *listing*, and *extinction* have become synonymous with the Atlantic Bluefin Tuna because the scientific facts have, and continue to, indicate that it is in great peril and nearing the tipping point of no return in terms of viability as a species, all because of short-term economics and politics.

This dissertation is rooted in complexity theory and public choice theory. The research design for this dissertation is based on the 5-component structure, *interactive model*, prescribed by Joseph A. Maxwell, Ph.D. (2004), and current policies were evaluated through the policy framework prescribed by Frank Fischer, Ph.D. (1995). Ten public policy steps are suggested to save the Atlantic Bluefin Tuna from collapse.

CHAPTER 1. OVERVIEW AND NATURE OF STUDY

As in manufacture so in science—retooling is an extravagance to be reserved for the occasion that demands it. The significance of crises is the indication they provide that an occasion for retooling has arrived.

--Thomas Kuhn, 1962

Introduction

The Atlantic Bluefin Tuna (*Thunnus thynnus*) is perhaps the most magnificent and most marvelous nomadic wild animal living in the world. It lives in the deep blue waters of the Atlantic Ocean and is one of the largest of the world's fin fish and largest of the 48 other species of tuna (International Commission for the Conservation of Atlantic Tunas [ICCAT], 2006, p. 94). It is a species that seems to have been designed and sculpted by an artist—sleek, smooth, lithe, and beautiful—instead of having been a product of an evolutionary process.

The tunas get their name from the Greek word meaning *to rush*, and to anyone who has seen them in the wild the name is fitting as they appear to rush everywhere, always in a hurry. The Atlantic Bluefin Tuna can cross and recross the Atlantic Ocean multiple times in the course of its life with bursts of speed exceeding 40 miles per hour; it can heat its body to more than 20 degrees above the ambient temperature, and it can dive to depths in excess of 1,500 feet seeking food (Lutcavage, Brill, Skomal, Chase, & Howey, 1999, p. 175). It is an *apex predator*, meaning that its place is at or near the top of the food chain, and as a result of being in this position it plays a significant role in keeping the other species living in the Atlantic Ocean in balance. The Atlantic Bluefin Tuna has been studied and researched for centuries and in spite of all of the compiled knowledge, it remains full of mysteries; it has habits and behavior not yet understood and many questions about it are not yet answered.

Today, the existence and future of the Atlantic Bluefin Tuna is in question because of the constant overexploitation of the stocks for its flesh. The insanely high prices being paid for its flesh have resulted in a modern day gold rush for almost any person who has the ability and equipment to catch the fish. Conservationist and scholar Carl Safina wrote, "This debate is more than academic, because an adult bluefin may be worth more money to the person who can kill one than any other animal on the planet, elephants and rhinos included" (Safina, 1998, p. 8). The movements of the Atlantic Bluefin Tuna take it through multiple jurisdictional, national, and international boundaries, spending part of its life in areas of the world's commons, also known as the high seas. In each, the species is managed through complex, often cloudy and poorly enforced, state, regional, and national laws, and international treaties. For decades the terms *overfished*, *under pressure*, *listing*, *collapse*, and *extinction* have become commonly used terms in the discussions of the Atlantic Bluefin Tuna because the scientific facts have, and continue to, indicate that it is in great peril and nearing the tipping point of no return in terms of viability as a species. It has reached this point largely because of short-term economics and politics.

From outer space, planet Earth appears to be a deep blue jewel-like sphere, dotted by a few brown-green islands all set in a background of darkness. The cobalt blue portions of the globe are a compound made up of two parts hydrogen and one part of oxygen held in a dynamic equilibrium to form the liquid commonly known as water. The characteristics of water are vastly different than those of the air above it, having a density 800 times greater, the capacity for sound to travel through it five times faster, and having 3,000 times more capacity to absorb heat. Not only is water the source of all life but without it life would cease to exist on the Earth. The astrophysicist Christopher McKay stated the importance of water to the planet best, "The single non-negotiable thing life requires is water" (cited in Earle, 2009, p. 10).

Most of the planet (139-million square miles) is covered by vast oceans and smaller seas that are composed of water that is salty, often briny (Earle, 2009, p. 10). The saltiness is created by 50-quadrillion tons of dissolved solids and salts (Carson, 1951, p. 188). It is harsh to the taste, contains very little oxygen (3% of that contained in the atmosphere), and if consumed internally by many of the world's inhabitants, it would cause a multitude of health problems, even death. However, the saltwater that comprises the oceans and seas is vital to all life on the planet. Earle (2009) wrote:

> Even if you never have a chance to see or touch the ocean, the ocean touches you with every breath you take, every drop of water you drink, every bite you consume. Everyone everywhere is inextricably connected to and utterly dependent upon the existence of the sea. (p. 11)

Although the oceans appear to be vast deserts, void of life, upon closer inspection the opposite becomes apparent as the oceans teem with the greatest diversity of life on the planet. Today, after thousands of years of observation, research, and study in the 21st century, discoveries of new species are frequent, almost daily occurrences. This vast diversity exists in all sizes and forms, ranging from the largest animal to have ever lived on Earth, the blue whale (*Balaenoptera musculus*), to microscopic single-celled microorganisms that live in the dark cold depths in conditions that do not appear to be suitable for any sort of life. More knowledge about the complexity of life in the oceans has been assembled than is understood, especially as related to the interaction and interdependence between the many forms of life. Earle (2009) wrote, "The fact is, we have barely begun to find and name the vast numbers of species in the ocean, much less understand how they work together" (p. 119).

Today, the world's oceans are in a state of crisis and on the verge of permanent and irreversible damage. For millions of years oceans and all of their biodiversity have worked as an interrelated system to bring life to the world. However, for the oceans to be so important to life on Earth, they have been taken for granted and severely abused for centuries by the human race. Since the beginning of human life, the oceans have been viewed as an inexhaustible source of food, minerals, fuel, revenues, profits, and recreation. Further, they have been a convenient dumping ground for everything from human waste and refuse to the depository of radioactive nuclear residues. In short, the refuse dumped in the oceans went to the bottom and became "out-of-sight-out-of-mind," supposedly no longer a problem. Earle (2009) wrote, "The Ocean came to be regarded as the ultimate dumpster" (p. 17). However, all of the abuses created by humans have caused environmental problems ranging from pollution to global warming and ocean acidification, each having contributed to the degradation of ocean life. Mitchell (2009) wrote, "Environmental problems that result from dramatic accidents receive more recognition more quickly than more serious problems that have resulted from ongoing and incremental processes" (p. 42). Walter Hickel (1919-2010), the 38th United States Secretary of the Interior, said, "The right to produce is not the right to pollute. . .we have become such proficient spoilers that not even the seas are too big for us to ruin" (cited in Weber, 2002, p. 119).

Today, with the world having more than seven billion people, conditions surrounding the depletion of the species that inhabit the oceans have become more acute; in part, because the peoples of the world have an insatiable appetite for food that is harvested from the oceans. For more than one billion people (1 in 7), food harvested from the oceans is a necessity because it is their only reliable source of protein and key to their survival (Earle, 2009, p. 222). In some parts of the world food harvested from the oceans is consumed by necessity; while in others certain

species are consumed because of choice, fashion; and some species are even consumed because they are considered to be aphrodisiacs. People, even many vegetarians, consume seafood of all types with less consciousness than they do other types of meat; perhaps this is because most fish are not warm-blooded animals, they cannot be easily observed or handled, or even because they do not have the opportunity of interaction. People view fish differently than other forms of sea life in general. Fish are considered to be food, therefore to be harvested and consumed. Other forms of sea life, such as whales and seals, are considered to be wildlife, therefore to be protected from exploitation. Campaigns such as "Save the Whales" and "Save the Seals" are familiar, recognized, and widely supported. However, any save the fish campaigns that exist are not widely known nor vigorously supported. Perhaps, there is an overall lack of understanding of the necessity and the important place the fisheries hold on the world's ecosystems. Regardless of whether food harvested from the ocean is consumed as a prime source of nutrition or because it is in vogue, the animals that live there do not command the same concern or engender the human connection as do other animals.

Clarity of terminology is essential in all studies regardless of subject. Some terms are controversial because they are used incorrectly or thought to be interchangeable. In any discussion of the future of a species, especially when the term *extinction* is used, requires definition. Extinction is a term that refers to the complete or total loss of species. The term could also be applied to one or more taxonomic units, for example a subspecies. In other words, the term is used when there are no surviving individuals anywhere. Extinction of any species is an irreversible loss of part of the Earth ecosystem. Extinction can be caused by unpredictable catastrophes, environmental events, or ecological stresses including competition, disease, or predation. The rate of extinctions has increased since the rise of the human being as the most

adaptable and dominant animal on Earth (Kaufman & Mallory, 1986, p. 1). Kaufman and Mallory (1986) wrote:

> Between the years 1600 and 1900, species of mammals and birds vanished at the rate of approximately one every four years. During the twentieth century, mammals and birds have disappeared at the average rate of about one species per year. (p. 1)

Pinsky, Jensen, Ricard, and Palumbi (2011) wrote:

> On land, life-history traits are strong predictors of extinction risk, and vulnerable species often have large body size and high trophic level. In marine ecosystems, the well-publicized declines of large predatory fishes suggest that similar trends may also be common in the sea. However, research to date has found or proposed a wide range of life-history characteristics that cause high vulnerability, including large body size, late maturity, long lifespan, low fecundity and high parental investment in offspring, or high trophic level. (p. 8318)

Examples of extinct species of land animals abound, including the Passenger Pigeon (*Ectopistes migratorius*), the Western Black Rhinoceros (*Diceros bicornis longipes*), and the Bermuda Shearwater (*Puffinus parvus*). Examples of extinct fresh water fish include, the Yellowfin Cutthroat Trout (*Oncorhynchus clarki macdonald*), the Blue Walleye (*Sander vitreus glaucus*) (also known as the Blue Pike), and the Bezoule (*Coregonus bezola*). Determining when a marine animal is extinct is problematic because of the size and complexity of the oceans.

The term *collapse* is the state of a species, or taxonomic unit, that has reached 90% depletion ("Collapse," 2006). When a fishery collapses, the affected species do not have the ability to recover to previous levels. Rigney (2012) wrote:

> Commercial extinction takes place when humans devastate a fish stock to the point that it loses its ability to recover and rebuild a population. The species often contracts in range, remains at very low numbers, and may even lose its functional niche in the ecosystem to other competing species. (p. 112)

Since commercial extinction is not a scientific term, Rigney's (2012) definition fits better as the definition of collapse. Hutchings (2000) wrote, "There is very little evidence for rapid recovery from prolonged declines, in contrast to the perception that marine fishes are highly resilient to large population reductions" (p. 882). Perhaps the most notable collapse of marine species is that of the Northern Cod (*Gadus morhua*) in Canada. Although difficult to predict, and even harder to prove, a collapsed species could eventually become extinct.

Today, in the first decades of the 21st century, many of the world's fisheries have arrived at the brink of collapse because of numerous reasons, including: pollution, loss of habitat, and overall disregard for their environment. However, overfishing the species of the ocean is the prime reason why some of the world's fisheries are no longer sustainable, are reaching the tipping point, and are on the brink of collapse. For centuries humans have taken fish for consumption, and curiously, with little regard to depletion. An example of this decline is the estimate that only 10% of the ocean's predatory fish remain (Myers & Worm, 2003, p. 280). This alarming precipitous decline continues with several species on the edge of collapse. Clover (2006) wrote:

> What we now know. . .global catches, which have risen ever since 1950, began to decline at the end of the 1980s. It took twelve years after that moment for this information to become public, even though it was of vital importance to the world's food supply. (p. 21)

Up to now and through all of the uses and abuses, overfishing, pollution, introduction of invasive species, loss of habitat, and overall disregard for their environment, the oceans have proven to be resilient enough to continue to satisfy human needs. However, as a result of the combination of natural factors and those created by human beings, the oceans of the world are nearing, and in some cases have reached, the limit of what they are capable of providing. Roberts (2012) wrote, "It is hard to grasp the prospect of seas so compromised that they no longer sustain the ecological process that we take for granted and upon which our comfort, pleasure, and perhaps even our very existence depends" (p. 215). Assuming the degradation continues at the current rate, one of the most serious consequences will be a total collapse of the fisheries on which the peoples of the world depend. This collapse will lead to starvation of many and the unrest and all of the consequences a hungry world will create, including the potential of rebellion and armed conflict. Further, the impact of species collapse could expose humans and animals to disease, noxious algal blooms, invasive species, and toxins.

According to a report of the United Nations Food and Agriculture Organization (FAO), 66% of the marine species humans have pursued since the 1950s have experienced collapse (Roberts, 2012, p. 215). Issenberg (2007) wrote, "From 1950 to 1971, the worldwide catches of all fishes grew by six percent each year [far outpacing population growth]" (p. 231). Clover (2006) stated that at the current trend the stocks of the fish human beings consume will have collapsed by 2048. Worm et al. (2006) wrote, "This isn't predicted to happen, this is happening now. If biodiversity continues to decline, the marine environment will not be able to sustain our way of life, indeed it might not be able to sustain our lives at all" (p. 787). Roberts (2012) wrote:

> In essence, what we have done the last few decades is to mine fish, bringing them in at rates faster than they can replace themselves. . .The price that must be paid for today's rapaciousness will be tomorrow's scarcity or, in some places, seas without fish. (p. 233)

And, the trend continues without an end in sight.

For the purpose of clarity, in this dissertation, the imprecise term *fishery* requires a precise definition. Initial research has produced some complex definitions that are not clear and others that are incomplete. The Fisheries Global Information System defines the term as "an activity leading to harvesting fish within the boundaries of a defined area; the fishery concept fundamentally gathers indication of human fishing activity including from the management, biological/environmental and technological view points" (Lleonart, Taconet, & Lamboeuf, 2006, p. 231). The FAO (2008) defines the term as "generally, a fishery is an activity leading to harvesting of fish. It may involve capture of wild fish or raising of fish through aquaculture" (p. 1). And, further as:

> a unit determined by an authority or other entity that is engaged in raising and/or harvesting fish. Typically, the unit is defined in terms of some or all of the following: people involved, species or type of fish, area of water or seabed, method of fishing, class of boats and purpose of the activities. (FAO, 2008, p. 1)

The National Oceanic and Atmospheric Administration (NOAA), charged with managing the saltwater fisheries of the United States, offers a similar explanation of the term stating, "'Fishery' simply refers to the activities involved in catching a species of fish or shellfish, or a group of species that share the same habitat" (NOAA "Fishwatch," n/d, p. 1). NOAA goes on to explain in detail the different fishery types: commercial**,** artisanal, industrial, subsistence, and recreational fisheries. Staaf (2012) defines the term as:

> The word 'fishery' refers to the whole operation, including the people who catch the animals (fishermen, boat captains), the equipment they use (boats, rods and reels, traps, scuba diving gear), the people who deal with the catch (purchasers and processors), and the billions of humans around the world who eat seafood. There are many different kinds of fisheries, from small-scale artisanal fisheries on remote islands, where children walk on the beach collecting sea cucumbers in a bucket, to huge industrial fishing fleets that use airplanes to spot fish schools and machinery to drop thousands and thousands of nets and hooks into the middle of the ocean. (p. 1)

Thus, the term spans business, recreation, geographic, and political boundaries, type of fishing equipment used or method of catch, species, ecosystem, and economics. Further, the preciseness of the term fishery or fisheries lies in its *in-preciseness*. For the purpose of this dissertation the term fishery will be used as a species-specific category for the species being discussed and where appropriate will be distinguished by two categories: recreational fisheries and commercial fisheries.

Although some smaller fisheries were becoming less commercially viable, the first indication that a real problem existed in the world's fisheries became apparent when the commercial Northern Cod (*Gadus morhua*) fishery of Nova Scotia, Canada collapsed and was subsequently closed in 1993 by the Canadian government. Safina (1998) wrote, "The international debacle in this region is the worst fishery management failure in the world" (p. 45). The Nova Scotia cod fishery had employed thousands of people and was a way of life for more than 500 years, dating to the days when John Cabot explored the waters of Newfoundland and Nova Scotia in 1497. Cabot had reported that the Northern Cod was so plentiful in those waters that in short order fishermen from many nations, including France, England, Spain, and Portugal began to exploit the resource ("Cabot," 1997, p. 36). As a result, the trading of cod became the subject of the first "global trade of seafood" (Issenberg, 2007, p. 171). Greenberg (2010a) wrote, "Cod became the first global fish commodity, mainly because it took well to preserving—dried

cod lasts for years and could be shipped around the globe even on the slowest ocean going vessels" (p. 231).

For five centuries the Nova Scotia cod fishery was apparently able to sustain itself and continue to be productive until the point in time when it reached the critical threshold or the tipping point, leading to its subsequent collapse. Gladwell (2002) defined the tipping point as, "the moment critical mass, the threshold, and the boiling point" (p. 12). Therefore, the tipping point is a certain critical point in a changing situation where change occurs that is no longer reversible. This concept of a tipping point originated in the medical field; however, the concepts and principals provide an appropriate framework and explanation in other fields. Scheffer (2009) wrote, ". . .once a threshold is exceeded, a positive feedback propels the system through a phase of directional change towards a contrasting state" (p. 53). Once the tipping point is reached, typically the collapse is almost immediate and is not a gradual trip to the contrasting state. In the fisheries, tipping points are difficult to predict because "the state of the system may show little change before the tipping point is reached" (Scheffer, 2009, p. 53).

After the collapse of the Nova Scotia cod fishery, scientists, biologists, and ichthyologists began to look at other fisheries throughout the world and found that many of the same problems they had observed, studied, and analyzed in the Nova Scotia cod fishery were widespread and indiscriminate of species. Ron Bulmer, President of the Fisheries Council of Canada, said, "The cod crisis has taught us a valuable lesson that others are going to have to learn: that we must err on the side of conservation" (cited in Safina, 1998, p. 108). Aside from environmental degradation problems, it was found that the prime culprit for fishery decline was overfishing or fishing in a nonsustainable manner. Thus, the established paradigm of overexploitation beyond the sustainable biological viability of a species was exposed.

Through the centuries, humans have become the most efficient predators the world has ever known on land. Humans have proven in memoriam their inability to show restraint in the face of greater efficiency. Efficiency is rooted in economic theory and is a quantitative measure of output in relation to input. The natural human tendency is to increase harvest (output) with the least amount of effort (input). However, when managing a natural resource, such as a fishery, an unstable ecological equilibrium can, and often does, develop. Roughgarden and Smith wrote in 1996:

> The problem of determining an optimal harvest rate is viewed as a problem in allocating capital between natural and financial stocks. . . .The problem is that this point of optimal harvest is an ecological unstable equilibrium under constant harvest. (p. 5079)

The collapse of the Nova Scotia cod fishery exposed the fact that humans have also become the most efficient predators of the oceans as well. However, exposing species that live in the water that are nearing the tipping point is more problematic because of the difficulties in determining a census. Empirically, it is known that fishery populations are in decline, fish sizes are smaller, spawn rates are lower, and in some places the fish are gone completely. However, the quantitative certainty is largely unknown. For example, anglers and fishers do not see or harvest the same quantities of Atlantic Bluefin Tuna as they did 50 years ago, and the Atlantic Bluefin Tuna they do harvest are typically smaller in size.

Through the invention of new methods of catch and improved technologies including the use of electronics, spotter aircraft, larger fishing vessels, instant freezing techniques, vessels that have longer range and storage capacity, modern materials that require little or no maintenance for nets, and stronger lines, efficiency has increased to the point that there is little chance of failure for a commercial fishing vessel to harvest fish unless the targeted species is depleted. For

example, until large capacity freezer units were adapted for large fishing vessels, fishers could only stay at sea as long as they had the ability to maintain ice in their holds.

Fishers use various and different methods to harvest the ocean's bounty, including long lining, purse seining, trawling, harpooning, the use of traps, weirs, gill nets, rod and reel, and others. In the modern era, the commercial interests employ aggressive fishing methods, of which some are massively destructive methods because they are indiscriminate of species taken or the ecosystem in which they are used. For example, trawling involves dragging the bottom of a body of water, in essence scrapping the bottom, removing not only the species sought, but everything else found there, leaving it barren. Clover (2009) stated that trawling "is like plowing a field seven times per year."

Purse seining and long lining are widely used methods of harvesting fish, especially when seeking the tunas and swordfish, both classified as highly migratory species. Purse seining was an invention of the 19th century and involves the encircling of a school of fish in a massive net and then it is drawn shut, like "a woman's purse" (Issenberg, 2007, p. 171). Long lining involves the laying of miles of baited hooks at varying depths. A ship will deploy the line and circle back to collect the catch. Every night enough long lines are deployed by fishers to circle the Earth 500 times (Roberts, 2012, p. 49). Not only are both methods very efficient, both lead to much loss through the indiscriminate waste of some species through a problem known as *bycatch*. The term bycatch used by the National Marine Fisheries Service (NMFS), also known as NOAA Fisheries Service, was by defined by the Magnuson-Stevens Fishery Conservation and Management Act as:

> Fish which are harvested in a fishery, but which are not sold or kept for personal use, and includes economic discards and regulatory discards. Such term does not include fish

> released alive under a recreational catch and release fishery management program. (NOAA Fisheries Service, n/d, para. 1)

Further, because this definition does not include other species regulated by NMFS, the definition is expanded to include, "Discarded catch of any living marine resource plus retained incidental catch and unobserved mortality due to a direct encounter with fishing gear" (NOAA Fisheries Service, n/d, para. 2). The International Game Fish Association defines bycatch as:

> Bycatch occurs when fishing operations result in discard of fish and invertebrates or interactions with marine mammals, seabirds, and sea turtles. Discard of fish may occur because certain species, sexes, or sizes are not marketable or are of lower value than other components of the catch, or because regulations prohibit retention of specific species, sexes, and/or sizes. Bycatch impacts living marine resources worldwide and occurs in both commercial and recreational fisheries. ("A new study," 2011, p. 6)

Long lining produces a high amount of bycatch because almost any animal that happens to be attracted to the bait including dolphins, some whales, sharks, sea birds, and sea turtles will be hooked; and since they are not able to get away or swim to the surface to breathe, these species are almost always dead when the line is collected. Typically, since these are not their targeted species, the carcass is discarded over the side. Purse seining generates a large amount of bycatch because any animal caught in the large net is doomed to drowning or crushing from the weight of other fish. Rybovich (1981) wrote, "Generally, purse-seine operations don't deal in thousands of pounds, they deal in tons, and they're capable of moving anywhere to get them" (p. 23).

The term *highly migratory species* was originally found in Article 64 of the United Nations Convention on the Law of the Sea (UNCLOS) (UNCLOS, 1986, 1993). Although UNCLOS does not define the term, Annex 1 lists the species the Convention considered to be

highly migratory. The list includes the tuna and tuna-like species: Albacore tuna (*Thunnus alalunga*), Bluefin tuna (*Thunnus thynnus*), Bigeye Tuna (*Thunnus obesus*), Skipjack tuna (*Katsuwonus pelamis*), Yellowfin tuna (*Thunnus albacores*), Blackfin tuna (*Thunnus atlanticus*), Little tuna (two species) (*Euthynnus alletteratus* and *Euthynnus affinis*), Southern Bluefin (*Thunnus maccoyii*); Frigate mackerel (two species) (*Auxis thazard* and *Auxis rochei*); Pomfrets (family: *Bramidae*); Marlins (nine species) (*Tetrapturus angustirostris*, *Tetrapturus belone*, *Tetrapturus pfluegeri*, *Tetrapturus albidus*, *Tetrapturus audax*, *Tetrapturus georgei*, *Makaira mazara*, *Makaira indica*, *Makaira nigricans*); Sailfish (two species) (*Istiophorus platypterus* and *Istiophorus albicans*); Swordfish (*Xiphias gladius*); Sauries (four species) (*Scomberesox saurus*, *Cololabis saira*, *Cololabis adocetus*, and *Scomberesox saurus scombroides*); Dolphin (two species) (*Coryphaena hippurus* and *Coryphaena equiselis*); Oceanic sharks (69 species) (*Hexanchus griseus*, *Cetorhinus maximus*, family: *Alopiidae*, *Rhincodon typus*, family: *Carcharhinidae*, family: *Sphyrnidae*, family: *Isurida*), and Cetaceans (105 species) (family: *Physeteridae*, family: *Balaenopteridae*, family: *Balaenidae*, family: *Eschrichtiidae*, family: *Monodontidae*, family: *Ziphiidae*, and family: *Delphinidae*) (UNCLOS, 1986, 1993). All of these are species that are widely distributed geographically live in the open ocean, near the surface and not near the bottom (pelagic); occupy the space at the top of the ocean food chain (high trophic); and undertake significant migrations in the ocean (oceanodromous) to feed and reproduce.

The food chain, also known as a predator-prey system, of the ocean operates in a similar manner as it does for land animals. An elementary explanation involves small animals being consumed by larger animals and the cycle continues for successively larger species or those in a higher trophic level. This cycle helps maintain balance in the ecosystem and if one link in the

chain is removed or damaged, an irreversible domino effect of decline can begin, ending only as species in subsequent levels of the food chain disappear. An example of how an interruption in the food chain can hasten the decline in a species is the case of the weakfish off of the East Coast of the United States.

The weakfish, in New England known as the Squeteague (*Cynoscion regalis*), is a saltwater fish of the drum family, *Sciaenidae*. It is named weakfish because of its fragile mouth, which tears easily when hooked and it has long been sought by commercial and recreational fishers. Like many other species, weakfish numbers have been declining and in 2005 the harvest along the Atlantic coast "plummeted to all time lows" ("The weak link," 2009, p. 1). The reason for the decline was stated clearly:

> In 2006, fishery scientists dug deeper into the data, including non-fishing impacts on the stock, and concluded that weakfish mortality is higher than ever. But unlike the '90s, over fishing isn't the culprit. Natural mortality, primarily due to predation and starvation…has been on the rise since the mid-1990s. ("The weak link," 2009, p. 1)

A break in the food chain, the decline of the menhaden—their primary food source, caused the decline of the weakfish, and has been the primary cause of starvation and predation. This example is only one of many that exist out of thousands, perhaps millions, of scenarios affecting the world's fisheries.

Purpose of the Study

Many of the world's fisheries have arrived at the brink of collapse because of overfishing, pollution, disregard for their environment, loss of habitat, catch methods, greed, carelessness, and countless other factors. The alarming and precipitous decline of marine animals continues, with several species now on the edge of collapse. The complexity of the

global fisheries policies is a subject that lends itself to investigation and empirical scrutiny. The purpose of this study was to examine the public policies surrounding the Atlantic Bluefin Tuna, and how they are formulated, implemented, and enforced by the international bodies that have a stake in the species. The gathered information was then analyzed and interpreted within an established and accepted analysis framework. This analysis led to a proposed policy to save the species from collapse.

Problem Statement

The questions and problems with the world's fisheries transcend national borders, cultures, mores, economics, politics, methods of catch, species, and bodies of water. As the tipping point arrives for the oceans of the world, the present paradigm must be shifted and new policies developed, adopted, established, and implemented. For centuries the prevailing and accepted paradigm has been one of increased efficiency, instead of a paradigm of sustainability. International public policies have not adapted to the reality that many of the world's fisheries have arrived at a point of collapse. Public policy may be the last best hope for the world's fisheries through the embracing of the paradigm of sustainability. This shift, however, must encompass international policy cooperation. The historian and philosopher, Thomas S. Kuhn wrote in 1962:

> The transfer of allegiance from paradigm to paradigm is a conversion experience that cannot be forced. . .The source of the resistance is the assurance that the older paradigm will wittingly solve all its problems, that nature can be shoved into the box the paradigm provides. (p. 152)

Sustainability is the view that "annual replenishment will balance those that are removed, a process that can continue indefinitely as long as sufficient numbers remain to reproduce the

next generation at a somewhat stable level" (Earle, 2009, p. 42). The species that live in the oceans are a natural resource that can be harvested responsibly without upsetting the fragile balance of nature. Sustainability, and practicing sustainability, is indiscriminate of species, national border, political philosophy, or creed. This is a policy problem because it is an issue that transcends all of the barriers that public policy is designed to manage—commerce, environmentalism, economics, foreign trade, behavior, and governance. The very precepts of public policy were created to provide structure and "rules of the game," a leveling of the playing field in issues that involve all peoples.

This dissertation focused on one of the apex predators of the ocean's food chain, the Atlantic Bluefin Tuna (*Thunnus thynnus*). It is a species that is widely agreed to be of vital importance to the marine ecosystem, a species that has enthralled millions of people throughout history by its magnificence, and has probably become the most mismanaged animal on the face of the Earth. If the Atlantic Bluefin Tuna were to disappear, the consequences to the ocean ecosystem could be dire. The state of the species is in crisis and today's paradigm of overfishing is askew; however, there is opportunity in crisis. The task to develop and implement the public policies necessary to save the Atlantic Bluefin Tuna will require a significant shift in the established paradigm. Kuhn (1996) wrote, "Since no paradigm ever solves all of the problems it defines and since no two paradigms leave all the same problems unsolved, paradigm debates always involve the same question: Which problems is it more significant to solve?" (p. 110). Further, Kuhn wrote, ". . .crisis loosens the rules of normal puzzle-solving in ways that ultimately permit a new paradigm to emerge" (p. 80).

This dissertation is not a treatise to ban the harvesting of the Atlantic Bluefin Tuna forever. However, to save the species may require the formulation, adoption, and

implementation of difficult, and perhaps draconian public policy positions, some temporary and others permanent. This dissertation is designed to shift the existing paradigm of exploitation and to seek and establish the best method to save the species through public policy. There are many questions to answer and that lend themselves to empirical scrutiny, including:

- Why is the Atlantic Bluefin Tuna so important?
- Why has the science been ignored?
- Is the species really in trouble?
- Is it possible to save the species from extinction?
- Is the species worth saving?
- What happens if no new policies are implemented?
- Is the international community capable of regulating a common resource?
- Is the public policy making process flawed?

Research Question

This dissertation will answer the question: What public policies should be established to save the Atlantic Bluefin Tuna?

Theory

The world is a complex system with interacting and interrelated components, each providing one element required by the next. In order to comprehend the Atlantic Bluefin Tuna fishery and the viewpoints that influence fisheries policy, a complex lens must be employed. This dissertation is rooted in complexity theory and secondly in public choice theory.

Concerning complexity theory, Mikulecky (2001) wrote, "The nature of the real world demands more than traditional science can deliver. Complexity science, as presented here, demands that the barriers and constraints be removed in order to gain a more complete view of

nature" (p. 341). Complexity is a growing science because the world and its problems cannot be fitted into the neat and confined boxes of individual problems and individual solutions. Further, the individual problem approach only can provide partial truths.

Public choice theory is an economic theory to study problems that are traditionally in the discipline of political science and public policy. In the political science perspective the theory deals with subjects where certain material interests dominate. Specifically, public choice theory is used to study the behavior of politicians, policymakers, and other government officials from the standpoint that they are self-interested players and how their self-interests apply to the system under the established constitutional rules. Public choice theory can be presented in different manners, but is most often used for normative purposes (what ought to be), to identify a problem, or suggest public policies that could be changed within the framework of constitutional rules and processes. Public choice will help in explaining "the Tragedy of the Commons," also known as the commons dilemma.

Hypotheses

H_1: The future state of the Atlantic Bluefin Tuna species is in danger of collapse.

H_2: There is a relationship between policy and fishing activity.

H_3: The current policy approach is failing and will eventually lead to a failed species.

H_4: Current management policy of Atlantic Bluefin Tuna is failing to maintain a sustainable population.

H_5: International policy makers are more interested in their respective constituencies' welfare than the welfare of the species.

H_6: Current public policy is not effective at governing the Atlantic Bluefin Tuna fisheries.

CHAPTER 2. LITERATURE REVIEW

"I cannot live without books: but fewer will suffice where amusement, and not use, is the only future object."
Thomas Jefferson to John Adams, June 10, 1815 (Cappon, 1987, p. 443).

The Literature

The literature and information available in the public domain concerning fish, fishing, angling, and public policy is almost endless. Examples of literature include treatises on specific fish: *Tuna: A Love Story* by Richard Ellis; histories of adventure and angling prowess, *Tales of Fishing Virgin Seas* by Zane Grey; epic fictional stories, *The Old Man and the Sea* by Ernest Hemingway; and comprehensive government reports, *An Ocean Blueprint for the 21st Century* by the U.S. Commission on Ocean Policy. Further, scientific papers and reports and fishery status reports are regularly issued by biologists, ichthyologists, nongovernmental organizations, international and domestic organizations, and others concerned with the fisheries. Each tome, journal, report, or article provides an explanation of the issues from a unique perspective and suggests a particular agenda, from solutions to restore the ocean's health to methods to maximize harvest.

The scientific literature often concerns conservation and is very detailed on the problems, recourses, and scientific facts. The scientific literature is typically very heavy on quantitative measurement and biologic function, but short on public policy suggestions or outcomes. The public policy literature is equally devoid of the science, setting up a collision between short and long-term regulation. The limiting factor of the data is the large quantity of data that is available combined by the defuse origin of the data. The issue is not whether data is available; the issue is

that the large quantity of information is not tied together to form a coherent and unified understanding of the ramifications the science attempts to explain.

All literature seems to agree that the fisheries require regulation; however, the proposed outcomes are scattered across the entire pubic policy spectrum. Fisheries regulations can affect all species and all methods of removing fish from the water. There are two operative definitions that require clarity in their distinctions in any discussion of fisheries policy—fishing and angling. *Fishing* is the act of collecting animals from the water for the purpose of sustenance or food. *Angling* is the act of collecting fish from the water for the purpose of sport and pleasure. Both are human traditions that span the ages and have their roots in the very beginnings of mankind. The results of this study have the potential to transform both of these functional definitions because establishing any effective public policy for management of the species will foster laws and regulations that affect catch-shares, methods of catch, catch age and size, and seasons.

This dissertation is rooted in two functional theories: complexity theory and public choice theory. Complexity theory is a relatively new theoretical basis that is growing in acceptance and use. The literature on complexity and complexity theory is limited in volume. On the other hand, since public choice theory is an older and more developed economic theory, it has broad and almost unending amounts of literature.

Complexity Theory

The world is a complex system with interacting and interrelated components, each providing one element required by the next. In order to comprehend the Atlantic Bluefin Tuna fishery and the viewpoints that influence fisheries policy, all facets of the regulatory environment and the natural science of the ecosystem must be examined. Complexity has been defined as "ranging from complex systems as more complicated versions of simple systems to complex

systems as compounded systems, truly different from simple system. . . ." (Teisman & Klijn, 2008, p. 288). Complexity theory provides a number of new approaches to the study of social, economic, political, and environmental systems (Manson, 2001). Therefore, this dissertation was rooted in complexity theory.

Complexity theory is a relatively new and revolutionary method developed to explain any type of complex system, from multinational corporations to mass extinctions (Manson, 2001). Lewin wrote, "Complexity theory is destined to be the dominant scientific trend of the 1990's . . .This revolutionary technique can explain any kind of complex system. . .All are built on the same few rules" (Lewin, 1992, [back cover]). Manson (2001) wrote, "Advocates of complexity see it as a means of simplifying seemingly complex systems" (p. 405).

However, the actual practice of examining complexity and complexity theory is anything but simple. Complexity theory can be traced, in concept, to four primary influences. First, the *philosophy of organism* developed by the mathematician and philosopher, Alfred North Whitehead (1861-1947) (Manson, 2001). Whitehead's work would evolve and eventually be called *process philosophy*, however, the principles of complexity remained behind. Secondly, the theory was influenced by the work of the American neurophysiologist and cybermetician, Warren Sturgis McCulloch (1898-1969), and logician in cognitive psychology, Walter Pitts (1923-1969). Their 1943 work centered around artificial neurons and neural networks (Manson, 2001). Artificial neurons are nonlinear mathematical representations of biological neurons that are summed to generate an output. Thirdly, the theory is rooted in the work of American mathematician, Norbert Wiener (1894-1964) in developing cybernetics in 1961 (Manson, 2001). The cybernetics approach is transdisciplinary and explores regulatory systems, their structures, constraints, and possibilities. It is essential to the study of mechanical, physical, biological,

cognitive, and social systems (Muller & Turia Kant, 2000). Fourthly, the theory was influenced by the work of John von Neumann (1903-1957), a Hungarian-American mathematician and polymath, on *cellular automata* (Manson, 2001, p. 406). This model can be studied in multiple disciplines and consists of a grid of cells in different states. Others would influence complexity theory, but in less profound ways. Manson (2001) wrote, "Complexity Theory also owes much to general systems theory given shared foci of anti-reductionism and holistic appreciation of system interconnectedness" (p. 406).

Mikulecky (2001) wrote, "The nature of the real world demands more than traditional science can deliver. Complexity science, as presented here, demands that the barriers and constraints be removed in order to gain a more complete view of nature" (p. 341). Complexity is a growing science because the world and its problems cannot be fitted into the neat and confined boxes of individual problems and individual solutions and can range across multiple disciplines. Further, the individual problem approach only can provide partial truths. For example, the study of a particular ecosystem not only involves the organisms that inhabit it (biology), the fauna (botany), but those that benefit from harvest (sociology), how they benefit from it (economics), and more. Manson (2001) wrote, ". . .exciting cross-fertilization occurs at the expense of potentially false leads" (p. 405).

Scientists and policymakers are typically specialists in certain fields, therefore, they spend the majority of their time thinking and studying a particular narrow segment of the world. Roberts (2012) explained:

> Each pore over a fragment of the world, turning it over in his or her mind like a chip of some mosaic. . .This means that impacts are discussed in isolation at different meetings and by different people who never quite see the overall picture. (p. 6)

Mickulecky (2001) went on to write, "The concept of complexity that is of so widespread interest was born within the confines of the scientific community, had to struggle for existence, and finally grew into a substantial force in scientific thinking" (p. 341).

Perhaps complexity in an environmental setting is best explained through Earle's (2009) discussion of the sea otter (*Enhydra lutris*) and abalone (*Haliotis sorenseni*) populations in the waters of the northwestern United States. These two species lived compatibly in the kelp forests off of the coast for more than 5 million years. Humans found the otter pelts desirable for use in clothing and over the decades, especially in the 19th century, hundreds of thousands of otters were killed for this use. The demand and subsequent harvest of otter pelts caused the species to experience a severe decline in population. In one of the earliest conservation efforts, the animals were given full protection in the waters of the United States in 1911 (Earle, 2009). After years of protection the otter population once again began to grow; however, as the otter population recovered the numbers of abalone began to drop at the same time. Earle (2009) wrote:

> Some see a cause-and-effect correlation—more otters, fewer abalones, discounting the impact of commercial abalone hunting. No doubt about it, otters eat abalone, as well as crabs, clams, snails, slugs, urchins, sea stars, worms—and numerous other creatures that stoke their hot-blooded metabolism. (p. 80)

All ecosystems are very complex and the waters in this area are inhabited by numerous species and upon further study the species were found to actually be interdependent. In this particular ecosystem sea urchins were also found in large numbers. With the depleted number of otters, the urchin exploded because their major predator had been reduced in numbers. The primary food source for both the sea urchins and the abalone is the same, kelp. However, the urchins tend to feed on the large holdfasts and stalks of the kelp "essentially mowing down the

forest" (Earle, 2009, p. 80). Since sea urchins can reproduce faster than the abalone, the abalone has a slower growth rate and a higher demand from humans; and since both feed on the same kelp for sustenance, and the major predator was reduced, a downward spiral effect took place in the ecosystem. The conclusion suggests that the otter may be the abalone's best friend because it helps to keep the urchin population in balance. Earle (2009) wrote, "In a healthy ecosystem, there is a place for everybody—kelp, otters, abalone, urchins, even a few people along with the thousands of other dynamic, living species" (p. 80). All components in a complex system are at once interrelated.

Complexity theory is also present and appropriate for use in the social sciences, including the development of public policy and the public policies themselves. May Brodbeck (1917-1983), one of the foremost American-born philosophers of science, wrote:

> Laws in social science, if we had them, would contain many more variables than those in physics. Yet we berate the social scientist for not being able to do what even the natural scientist cannot do. The multiplicity and complexity of factors in social phenomena impose limitations upon what we can reasonably expect to achieve. These limitations are only a practical, though perhaps practically insuperable, difficulty and we simply do the best we can. (1962, p. 47)

Thus, the social sciences are complex and often difficult to understand and interpret. Teisman, and Klijn (2008) wrote, "By applying complexity theory to governance processes they also contribute to what may become or may be called an evolutionary approach to public administration" (p. 290). This approach is pertinent because it frames all of the perspectives that comprise the policymaking, administration, and enforcement arenas. Meek (2010) wrote:

> Complexity Theory offers enormous potential for improving our understanding of both policy development and public administration. The central concepts of non-linearity, emergence, self organization, complex adaptive-systems provide attractive insights about behavior that helps address the limitations of rationally based policy and administrative logics that have guided much of our efforts in these areas of inquiry. (p. 1)

The use of complexity theory is appropriate for use in this study because it is the nexus of an apex predator of the world's oceans and the regulation of that particular species. The public policies surrounding the Atlantic Bluefin Tuna resulted from a tangle of influences from interested parties and not necessarily from rational thought. Lindblom (1959) pointed out the limitations of rational thinking in the policymaking process. While not specifically pointing out complexity theory, Lindblom provided the base to recognize alternative methods of understanding logics and protocols. Meek (2010) wrote:

> The central concepts complexity theory examined here—self-organization, non-linearity, coevolution, connective capacity, emergence, dissipative structures, intermediate structures—receive continued attention as to how they can assist our understanding of the dynamic and evolutionary nature of the policy context and how policy-makers are to consider their own interactive and emergent, even co-evolutionary role in the policy context. (p. 3)

Public Choice Theory

The second theoretical basis for this dissertation is public choice theory. Public choice is an economic theory used in the study of problems that are traditionally covered by the disciplines of political science and public policy. In the political science perspective, the theory deals with subjects where certain material interests dominate. Specifically, public choice theory is used to

study the behavior of politicians, policymakers, and other government officials from the standpoint that they are self-interested players and how their self-interests apply to the system under the established constitutional rules. Public choice theory can be presented in different manners, but is most often used for normative purposes (what ought to be), to identify a problem or suggest public policies could be changed within the framework of constitutional rules and processes.

Public choice assisted in the explanation of "the Tragedy of the Commons," also known as the *commons dilemma*. The concept was originally proposed in 1968 by Garrett Hardin, recipient of the 1986 Nobel Prize in Economics. Hardin was attempting to explain that there was no technical solution to the population problem. Thus, Hardin (1968) explained:

> The tragedy of the commons develops in this way. Picture a pasture open to all. It is to be expected that each herdsman will try to keep as many cattle as possible on the commons. Such an arrangement may work reasonably satisfactorily for centuries because tribal wars, poaching, and disease keep the numbers of both man and beast well below the carrying capacity of the land. Finally, however, comes the day of reckoning, that is, the day when the long-desired goal of social stability becomes a reality. At this point, the inherent logic of the commons remorselessly generates tragedy.
>
> As a rational being, each herdsman seeks to maximize his gain. Explicitly or implicitly, more or less consciously, he asks, "What is the utility to me of adding one more animal to my herd?" This utility has one negative and one positive component.
>
> 1. The positive component is a function of the increment of one animal. Since the herdsman receives all the proceeds from the sale of the additional animal, the positive utility is nearly + 1.
>
> 2. The negative component is a function of the additional overgrazing created by one more animal. Since, however, the effects of overgrazing are shared by all the herdsmen, the negative utility for any particular decision making herdsman is only a fraction of -1. (p. 1244)

Further, Hardin (1968) wrote:

> Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit-in a world that is limited. Ruin is the destination toward which all men

> rush, each pursuing his own best interest in a society that believes in the freedom of the commons. Freedom in a commons brings ruin to all. (p. 1244)

The problem of the commons is the classic issue in any attempt to regulate the world's fisheries, especially the Atlantic Bluefin Tuna. Baron (1998) wrote, "In a commons dilemma, many people face the same pair of options: cooperation or defection. Defection [fishing as much as possible] is better for each individual, and cooperation [restraint] is better for everyone else" (p. 23). James Buchanan, Nobel Prize-winning economist and public choice scholar, argued:

> Individuals come together in politics for their own mutual benefit, just as they come together in the marketplace; and by agreement among themselves they can enhance their own well-being, in the same way as by trading in the market place. (cited in Dye, 1998, p. 32)

The Atlantic Bluefin Tuna

The Atlantic Bluefin Tuna is a biological marvel and one of the iconic aquatic animals that inhabit the Earth. It is an animal that has been sought, consumed, described, studied, discussed, and mythologized for thousands of years. Its image has been memorialized in many ways, from ancient urns to modern-day postage stamps. The Atlantic Bluefin Tuna is the subject of some of the oldest cave paintings in the Mediterranean region (Maggio, 2000). Ancient scholars, such as Aristotle and Pliny the Elder, described in detail its movements, behavior, biology, and physiology. Ancient poets, such as Homer and Oppian, wrote of epic battles between the species and humans. Modern day authors, such as Zane Grey and Ernest Hemingway, described its strength, beauty, and grace in prose. Modern day scientists, such as Bruce Collette, Carl Safina, and Barbara Block have studied its biological and physiological systems through the lens of modern science. Sportsmen such as the late Bill Carpenter and the

late Frank O'Brien sought it to experience their brute strength, pull, gaminess, and the challenge of the potential "conquest over a king." In the late 20th century sophisticated-palated people began to desire its meat for the taste, texture, experience, and fashion because it provided the suggestion of worldliness, wealth, and elitism. This fish, described by Safina (1998, p. 8) as a "saber-finned warrior from another world" and the "perfect master of its element" has held a lofty perch in desires and cultures by human beings for many centuries. Unfortunately, the majority of humans will never have the opportunity to appreciate the true majesty of these animals, experiencing them only as small red pieces of flesh in sushi and sashimi.

History

The global significance of the Atlantic Bluefin Tuna cannot be understated because its biological uniqueness and beauty has been revered and its flesh has fed entire civilizations for centuries. It must be noted that in early writings the Ancients did not discriminate between tuna species, typically referring to all tunas as *tunny* or *tunnies*. However, as Aristotle and others described the size of the fish, where located, physical attributes, and behavior of the various tunnies, it is clear and without doubt, the Atlantic Bluefin Tuna was the subject being discussed in their literature.

The bluefin tuna has been a valued source of nutrition throughout human history. Farwell (2001) wrote:

> . . .shell mounds containing skeletal remains of *Thunnus* species have been found indicating they were part of the early diet of humans. *Thunnus* bones date from the early to middle Jomon period of Japan, 6,000-4,000 B.P. and in coastal areas of British Columbia from 3,000 years B.P. (p. 392)

Evidence shows that large quantities of Atlantic Bluefin Tuna were caught in the Mediterranean Sea as early as 8,000 B.C. (Pepperell, 2011, p. 82). Around 2,800 B.C., the Phoenicians reportedly were the first to catch large quantities of bluefin tuna off of the western coast of Sicily; and as a result of their success they established a commercial fishing center there, including a salt works (Kurlansky, 2008, p. 45). Salt curing animal flesh, especially fish, is a preservation method that has been used for centuries which preserves the meat for an indefinite period of time. The process was essential to allow transport to markets beyond a few hours or a day from the sea, making its flesh a tradable commodity. The Phoenicians established some of the fisheries that continue to exist today throughout the Mediterranean (Kurlansky, 2008, p. 46).

The Greek philosopher and scholar Aristotle (384-322 B.C.) wrote in *The History of Animals* that bluefin tuna reproduced in the Bosporus and were caught in the Black Sea. He pondered the origin of the species and was intrigued by their migration, calling the species "gregarious" (Aristotle, 1883, p. 4). He wrote:

> The tunny conceals itself during winter in deep places, and they become fattest at this season. The season of capturing them commences with the rising of Pleiades, and continues to the end of the setting of Axcturus. All the rest of their time they remain quiet in concealment. A few of these are taken during the period of their concealment, and so are some other hibernating creatures, if they are disturbed by the warmth of their abode or the unusual mildness of the season. For they come out a little from their holes to feed, and also when the moon is full. (Aristotle, 1883, p. 214)

The Carthaginians sought the Atlantic Bluefin Tuna for human consumption and held the species in such high regard that they memorialized it by depicting its image in art and placing it on their coins (Ulanski, 2008). Later, the fish were caught in large quantities to feed the Roman army and, again, held in such high regard that its image was placed on Roman money and works of art. Roman author, naturalist, and philosopher Pliny the Elder (23-79 A.D.) described their size in *History of Nature*, "The Tunnies are exceeding large fishes: we have found some to have

weighed fifteen Talents [greater than 1,000 pounds] and the breadth of the tail to be two Cubits and a Span [forty-four inches]" (Pliny the Elder, 1601/1847, p. 124). Concerning their habits, he wrote:

> The fishery for tunnies is from the rising of the [stars] Vergilise to the setting of Arcturus. All the Winter-time besides they lie hid in the gulfs at the bottom, unless they are enticed forth by some warm season, or at the full moon. They grow so fat, that their skins burst. (Pliny the Elder, 1601/1847, p. 128)

Further, Pliny "championed the use of various parts of the tuna as homeopathic remedies for a host of human ailments" (Ulanski, 2008, p. 88). Three centuries apart, both Pliny the Elder and Aristotle were describing migrations of what today is known as the Eastern stock of the fish.

The Greek turned Roman author and historian Plutarch (46-120 A.D.) was concerned with the moral and social topics of his time and among his writings are an in-depth treatise on whether terrestrial or aquatic organisms were smarter. Ulanski (2008) wrote, "He described schooling behavior of tuna as a conscious act that expresses their affection for one another, assigning almost human qualities to them" (p. 88). Perhaps Plutarch was the first to describe the apparent complex social structure and parabolic-shaped hunting formation that continues to marvel modern day ichthyologists.

A millennium-and-a-half later, during the voyages of discovery (1492-1502), Columbus wrote in his journal of seeing tuna in mid-ocean going east (Anderson, 1990, p. 219). And a half-millennium later in 2008, Richard Ellis, wrote *Tuna: A Love Story*, a book dedicated to the species, in which he discussed issues from conservation to the challenges and perils of tuna ranching. In short, the Atlantic Bluefin Tuna has been a source of fascination, intrigue, study, and empirical scrutiny for centuries.

Life begins for the Atlantic Bluefin Tuna in one of two known spawning areas, the Gulf of Mexico and the Mediterranean Sea. The Atlantic Bluefin Tuna born in the Gulf of Mexico travel typically through the Straits of Florida thousands of miles up the East Coast of the United States to the cold waters of Georges Bank and Nova Scotia, Canada. They return to the Gulf of Mexico via the center of the Atlantic Ocean and the Caribbean islands to begin the cycle anew. The Atlantic Bluefin Tuna spawned in the Mediterranean Sea typically embark on a similar migration on the opposite side of the Atlantic Ocean, coming out of the Mediterranean Sea and returning via the British Isles and center of the Atlantic Ocean.

In 1982, ICCAT established a dividing line at 45ºW longitude for purposes of managing the Atlantic Bluefin Tuna. Thus, establishing a distinction between the Eastern population, or Eastern stock, and the Western population, or Western stock. This separation of stocks has been, and continues to be controversial because it is an arbitrary line of division established by a fisheries management organization and not necessarily a boundary to which nature adheres. Although ICCAT has claimed that there are two distinct and separate stocks, there is mixing between the two stocks.

The Eastern Population

The Mediterranean Sea is the area typically associated with the Eastern stock. It is the home to the oldest Atlantic Bluefin Tuna fisheries, some dating in the thousands of years. The fish in the Eastern stock tend to grow faster and sexually mature at an earlier age than those in the Western stock (Pepperell, 2011). For decades it was believed that the fish spawned in many areas of the Mediterranean Sea, however, scientists have discovered their primary spawning grounds are in the Tyrrhenian Sea, north of Sicily (Anderson, 1990).

In the Mediterranean Sea the harvesting of the fish has deep ceremony, pageantry, and cultural ties. The most recognized and famous mass harvest of bluefin tuna in the Mediterranean Sea is the Mattanza that takes place in May and June off of Sicily. It is an Italian tradition that has its roots in Spanish and Arab culture (Ulanski, 2008). For the Mattanza, "The local fishermen, *tonnarotti*, construct and set a complex series of large traps, *tonnaras*, which are composed of numerous passageways, chambers, and gates to ensnare the tuna" (Ulanski, 2008, p. 87). Opian wrote in the second century of "nets arranged like a city" with "rooms and gates and deep tunnels and atria and courtyards" (Issenberg, 2007, p. 228). Once this type of fishing was widespread and called by different names: in Portugal, *armaoes*; Spain, *almandrabas*; and in France, *madragues* (Maggio, 2000, p. 250).

In the 20th century with increasing pressure to produce fish, the Mattanzas became corrupted by modern-day processes. Historically, the number of fish entering the tonnaras was highly anticipated and celebrated in the various fishing towns. However, as a result of market pressures, this information began to be shrouded in confidentiality. Maggio (2000) wrote, "If the buyers got wind of [how] many fish were in the trap, the price of bluefin on the world market would plummet" (p. 154). Bluefin tuna farming in the Mediterranean began in 1979 as an effort to satisfy demand (Ellis, 2008). The fallacy of these operations is that they are actually fattening pens, rather than actual fish farms. These operations involve rounding up wild fish, penning them, and feeding them until they reach a certain weight instead of hatching the fish and raising them to market size. Tuna farming is controversial because it removes biomass from the wild stocks and requires more input of other wild-caught fish to feed the Atlantic Bluefin Tuna than output of weight. Tuna farms are found in Spain, Morocco, Malta, Syria, and other countries. In

2001, 12 Mediterranean Sea tuna farms produced 11,000-tons, "more than half the world's total" (Ellis, 2008, p. 164).

The Western Population

The Gulf of Mexico and the Atlantic Ocean off of the East Coast of the United States is the area typically associated with the Western stock of the fish. Although the reason has not been definitively determined, the fish of the Western stock have a slower growth rate and sexually mature at an older age that in the Eastern stock (Pepperell, 2011). The spawning area is apparently confined to a small area in the Gulf of Mexico, south of the Louisiana coast. Although the Western stock does not have the long history with humans as the Eastern stock, the fish were apparently harvested in sizeable quantities by Native Americans. Ruais (2011) wrote, "Although the history of fisheries for bluefin in the western Atlantic cannot match the longevity of the Mediterranean fisheries, it is well documented that Native Americans were fond of bluefin flesh, especially smoked" (p. 3).

Biology

The Atlantic Bluefin Tuna appeared in the oceans between 1 and 2 million years ago (Corson, 2007). It is the largest member of the *Scombridae* family of fishes, which includes 55 species and 2 subfamilies of fish and all of the mackerels (Rooker et al., 2007, p. 265). All of the scombrids are generally open ocean predators. The Atlantic Bluefin Tuna is considered to be highly migratory because of its vast range of migrations spanning two of the Earth's hemispheres. It is *epipelagic*, meaning that it lives in the upper layer of the ocean, and is *rheotactic*, meaning its movement is towards or away from a current of water species (Ulanski, 2008). The Atlantic Bluefin Tuna prefers to migrate in favorable (away from) currents, typically

in the ocean-rivers of the Earth such as the Gulfstream (Ulanski, 2008). Spawning grounds and migration patterns of the Atlantic Bluefin Tuna are illustrated in Figure 1.

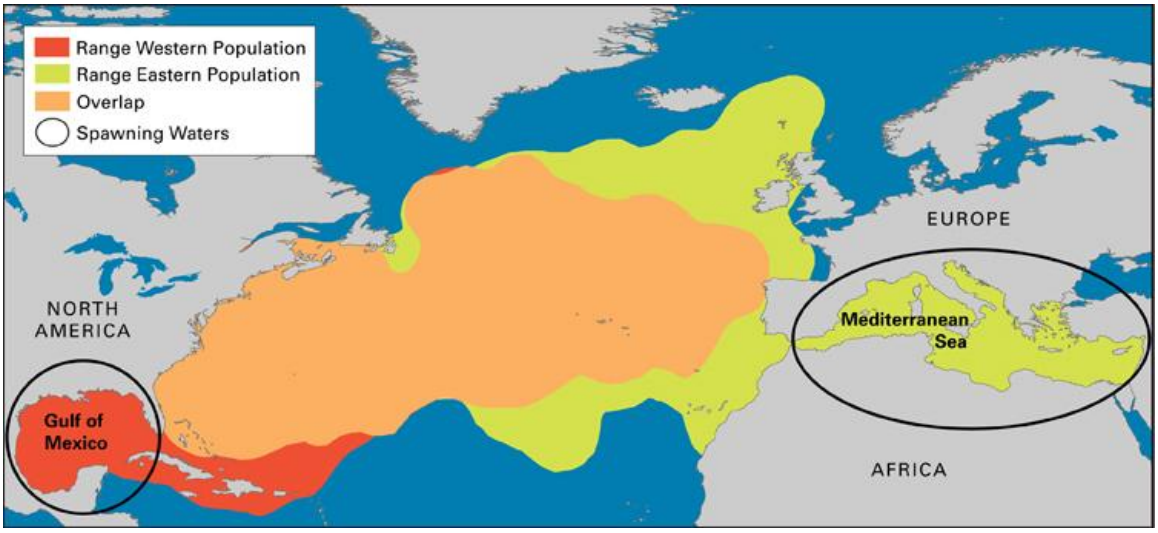

Figure 1. Spawning areas and migratory range of the Atlantic Bluefin Tuna.

Adapted from Stanford University and the TAG-A-Giant Foundation, http://ocean.si.edu/ocean-photos/atlantic-bluefin-tuna-distribution-map

The Atlantic Bluefin Tuna begins its life in one of two known spawning grounds: the Gulf of Mexico or the Mediterranean Sea. It has spawning site fidelity, meaning that it returns to the same area where it was hatched to procreate. Most species of tuna spawn over large open areas, however, the Atlantic Bluefin Tuna has "discrete, well defined spawning grounds" (Pepperell, 2011, p. 86). Figures 2 and 3 display spawning area and habitat of the Atlantic Bluefin Tuna (Western stock). Figure 4 indicates the spawning area and habitat of the Atlantic Bluefin Tuna (Eastern stock). It is an oviparous fish, meaning that eggs are expelled with no or very little development within the mother. The females are highly fecund, producing 128.5 eggs per gram of body weight, and mature females produce between 15 and 75 million eggs depending on its size and age (Pepperell, 2011, p. 86). For example a 700-pound fish will

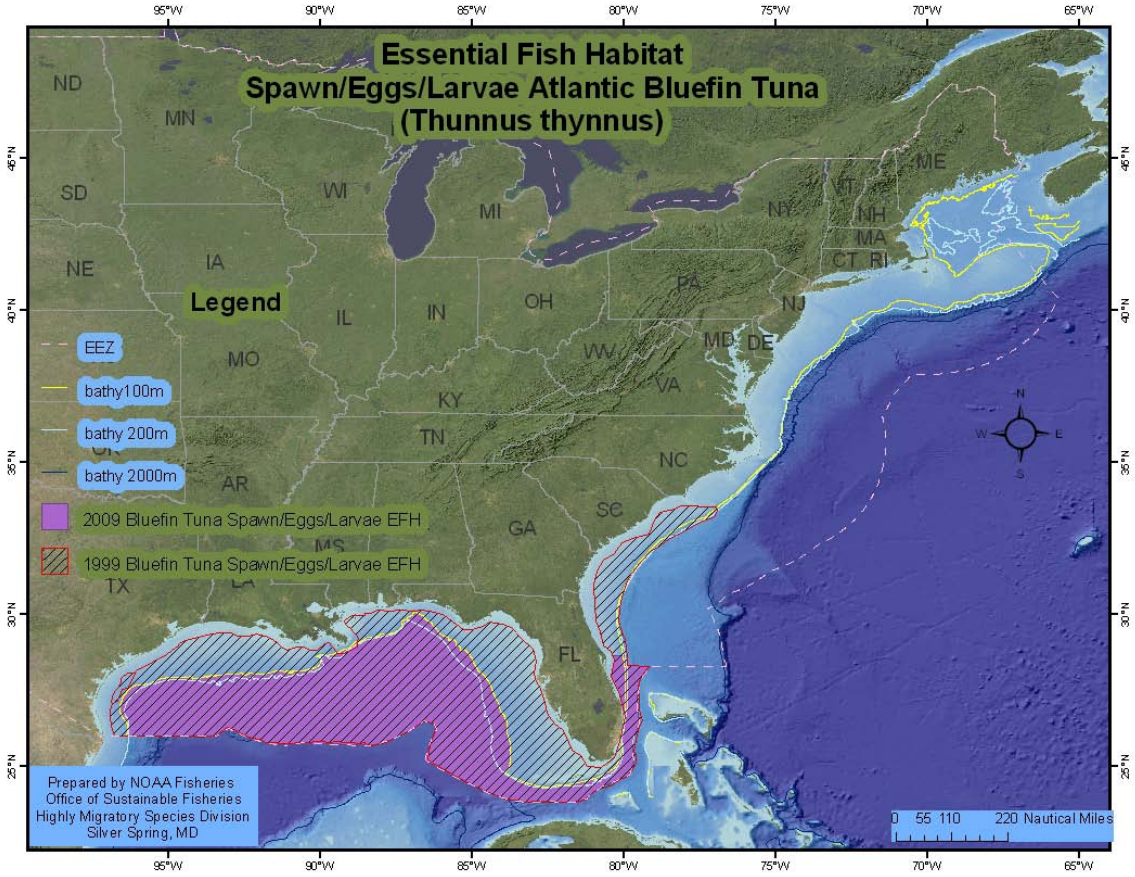

Figure 2. Essential habitat of the Atlantic Bluefin Tuna (Western stock).

Adapted from "Status Review Report of Atlantic Bluefin Tuna (*Thunnus thynnus*)," by the Atlantic Bluefin Tuna Status Review Team for the National Marine Fisheries Service, National Oceanic and Atmospheric Administration, 2011, p. 8.

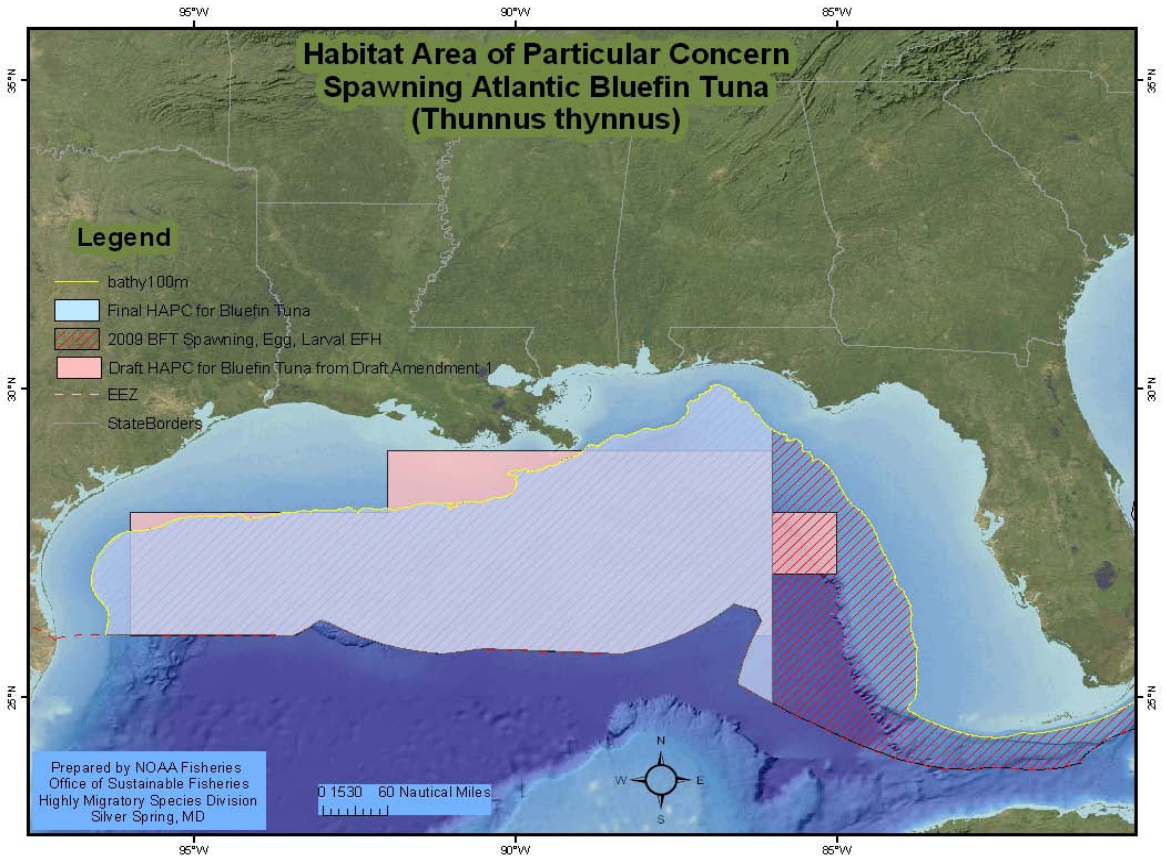

Figure 3. Spawning area of the Atlantic Bluefin Tuna (Western stock)(in light blue). The figure shows the boundary for Bluefin tuna spawning, egg, and larval EFH (hatched areas).

Adapted from "Status Review Report of Atlantic Bluefin Tuna (*Thunnus thynnus*)," by the Atlantic Bluefin Tuna Status Review Team for the National Marine Fisheries Service, National Oceanic and Atmospheric Administration, 2011, p. 11.

Figure 4. Spawning area of the Atlantic Bluefin Tuna (Eastern stock).

Adapted from "Status Review Report of Atlantic Bluefin Tuna (*Thunnus thynnus*)," by the Atlantic Bluefin Tuna Status Review Team for the National Marine Fisheries Service, National Oceanic and Atmospheric Administration, 2011, p. 13.

produce 40,837,300 eggs (Whynott, 1995, p. 20). It has been found that the eggs in one female fish alone can weigh more that 15 pounds (Ulanski, 2008, p. 89).

When expelled from the female, the eggs are a tiny 1-millimeter in diameter (Whynott, 1995, p. 20). Once fertilized, the resulting embryos grow rapidly; at 1 week the embryo has developed into a free swimming hunting fish one-half inch long (p. 20). At 9 days, it has become a feeding machine with spinny fins, big eyes, big jaws, and sharp teeth (p. 20). However, despite the great numbers of eggs and embryos, the mortality rate is high because the embryos tend to congregate in the same space as krill and plankton where they are consumed by other predators. By the second week 50% are lost, and at 1 year 99% are lost. Perhaps, this situation is a part of nature's balancing act.

Figure 5. Atlantic bluefin tuna larvae.

Adapted from NOAA Photo No. X-5mm. Retrieved at http://www.nmfs.noaa.gov/gallery/images/photos/5751104894.html

The surviving 1% will be a part of vast migrations for the rest of their lives. Atlantic Bluefin Tuna migrations and movements through the aquatic ecosystem have been the subject of much mystery for millennia. The Ancients believed that in those times when the fish were not visible they, as Pliny the Elder (1601/1847) wrote, "hid in the gulfs at the bottom" and as

Aristotle (1883) wrote "conceals itself during winter in deep places." A similar belief would carry into the 20th century when the first in-depth studies of their migrations took place.

The Atlantic Bluefin Tuna has an obvious and closely defined social structure that is most evident during its migrations. They employ a "parabolic-shaped" formation, which is evidence of a "very advanced social grouping" for fish (Safina, 1998, p. 23) (see Figure 6). The fish at either end of the parabola must be able to see each other and the formation is reorganized should they lose sight of one another (Safina, 1998). Partridge, Johansson, and Kalish (1983) wrote, "Giant bluefin exhibit the most rigidly defined school structure which has yet been observed. The degree of organization and the rules defining it however, are functions of the number of individuals in the school" (p. 254).

The parabola formation serves two purposes. First, the shape provides energy savings that allow the fish to swim more easily "with their pectoral fins outstretched, the bluefin take advantage of lift generated by their neighbors. . .they can also gain increased thrust without increasing effort by 'pushing off' of the compaction of water against each other" (Safina, 1998, p. 23). Secondly, the formation serves as a dragnet, "allowing the bluefin to corral and envelop prey schools they encounter as they travel" (Safina, 1998, p. 23). Partridge et al. (1983) went on to write, "We believe that the parabolic school formations of tuna provide strong, if circumstantial, evidence for true cooperative hunting of the sort usually associated with cetaceans or group living carnivores such as lions and wolves" (p. 261).

The highly migratory nature of the Atlantic Bluefin Tuna requires specialized biological systems for its function and survival. In order to navigate, it has a *pineal eye* or *pineal apparatus* on the black dorsal area of the head, a characteristic that may be found in other scombrids. It is

Figure 6. The parabolic-shaped hunting formation of the Atlantic Bluefin Tuna.

Adapted from Ocean Aerials, http://oceanaerials.com/Tuna.html.

an area described by Rivas (1953) as a "broadly elliptical, depigmented patch, about the size of the pupil" (p. 169). It is further described as a "translucent oval 'window' in the skin at the interorbital region, leading to the brain and transmitting light, by means of a tube through a foramen in the skull" (Rivas, 1953, p. 168). Ulanski (2008) wrote, "In conjunction with the photoreceptors contained within the pineal organ, this third eye assists in the processing of light cues, such as the position of the sun" (p. 90). Further, it can navigate with little or no sun (Ulanski, 2008).

Most fish are *ectothermic*, meaning they are cold blooded; however, the Atlantic Bluefin Tuna is an *endothermic* fish, meaning it is warm blooded, having the ability to raise and lower its own body temperature at will. Since the fish can dive in excess of 1,500 feet in search of food, this ability preserves proper function of muscles and other body systems. Three factors allow this. First, the circulatory system of the tuna differs from other fish in that the blood is supplied to the muscles through large lateral cutaneous vessels instead of through a centrally located aorta (Carey & Teal, 1969). Secondly, blood enters and exits the muscle structures through a network of small parallel arteries and veins stemming from the lateral vessels. This network is known as the *Rete mirabile*, defined as a "wonderful net" that acts as a "heat exchanger" throughout its body (Safina, 1998, p. 56). Thirdly, tuna hearts, especially those of the Atlantic Bluefin Tuna are larger than those of other fish, they beat faster consequently the volumes of oxygenated blood distributed to their muscle mass is greater, giving the flesh a beef-like dark red color. Carey, Kanwisher, and Stevens (1984) wrote:

> The high visceral temperatures are probably important in allowing them to take maximum advantage of a food supply which may be only sporadically abundant. When

the herring, mackerel, sand eels, etc. are available the tuna can process them rapidly and load enough fat onto their bodies to last them through the next migrations. (p. 19)

The species has a unique appearance and everything about its body exemplifies that it was designed for speed. It has been described as having "an elongated fusiform [wide in the middle, tapering towards both ends] body, being more robust at the front" (*ICCAT Manual*, 2006, p. 294). The shape is aqua-dynamically efficient. Safina (1998) wrote, "Engineers from the Massachusetts Institute of Technology are now designing underwater vehicles based on the shape and propulsion method of the tuna, as a way to achieve previously undreamed-of efficiency" (p. 60). It "displays 39 vertebrae and 12 to 14 dorsal spines and 13 to 15 dorsal soft rays" (*ICAAT Manual*, 2006, p. 94).

The Atlantic Bluefin Tuna has scales, however, they are so small that its skin appears to be, and feels smooth to the touch. This allows the water to pass over its body with minimal resistance. Like all animals, the coloration of the Atlantic Bluefin Tuna has unique characteristics. The fish's entire body has an iridescent quality. Its dorsal area (back) is a metallic blue to almost black, the lower sides range from silver to copper in color with oblique pale lines and spots on its lower sides. Figure 7 illustrates the adult Atlantic Bluefin Tuna as painted by Val Kells, marine artist and author (see Appendix A).

The Atlantic Bluefin Tuna has short pectoral fins, "less than eighty-percent of head length" (*ICCAT Manual*, 2006, p. 95). The second dorsal fin is higher or longer than the first and is reddish-brownish in color (*ICCAT Manual*, 2006, p. 94). Slots in to which they can fold both their pectoral and dorsal fins exist and are unique to the Atlantic Bluefin Tuna, further reducing drag during bursts of speed (Safina, 1998, p. 59). The anal fin has a dark margin and it

has dusky yellow “finletsw1`” on the top and bottom of the rear-third of its body (Kells & Carpenter,

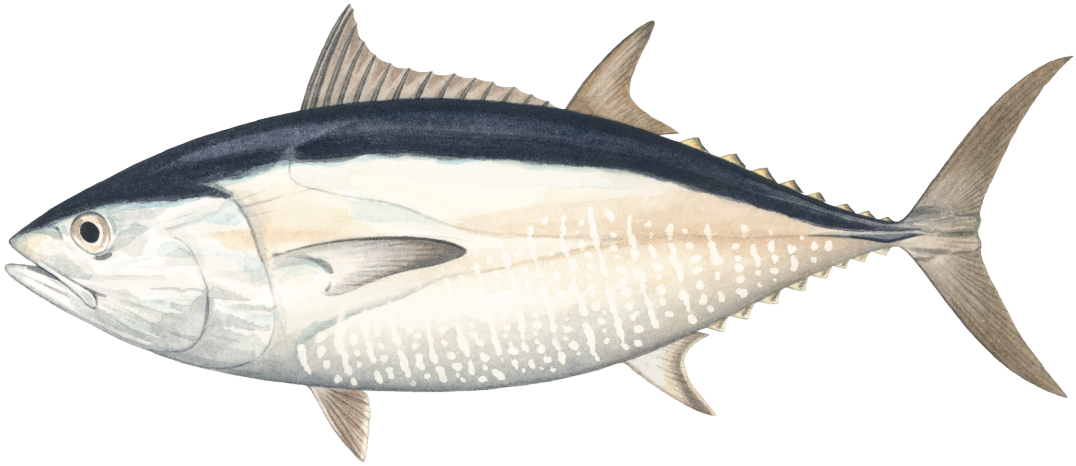

Figure 7. Adult Atlantic bluefin tuna as painted by Val Kells, marine artist and author.

Provided by contract by the painter to the author for this dissertation. Copy of contract found in Appendix A.

2011, p. 384). These finlets produce little vortices or disturbances, which break up the thin layer or laminar flow of water that flows across its body, eliminating drag (Safina, 1998).

Each side of the caudal fin has a blackish horizontal keel to stabilize the fish, enhance turning ability, and minimize water resistance as the tail moves (Safina, 1998). The caudal fin or tail is *heterocercal*, equal lobed and *lunate*, crescent-shaped (Ellis, 2008, p. 22). Most fish move the entire rear third of their body to develop their swimming motion. The musculature of Atlantic Bluefin Tuna is designed to move only the tail in a side-to-side motion, accomplished through its powerful lateral muscles (Ellis, 2003).

Like other scombrids, the Atlantic Bluefin Tuna is relegated to a life of continual motion in order to breathe and stopping would lead to suffocation and drowning. It gathers oxygen through ram ventilation, forced water across its 31 to 43 gill rakers, which are located on the first gill arch (Pepperell, 2011). As a result, they have more breathing surface area and more hemoglobin to carry oxygen to their muscles than all other fishes (Safina, 1998). Ulanski (2008) wrote, "The size of the total respiratory area approaches that found in the lungs of mammals of comparable weight" (p. 97).

From an egg less than 1 millimeter in diameter the Atlantic Bluefin Tuna throughout the course of its life experiences exponential growth, specimens have been known to reach more than 15 feet in length and weigh in excess of 1,800-pounds (Vessey-Fitzgerald & LaMonte, 1949, p 183). It is believed that the fish can live for more than 30 years.

The Atlantic Bluefin Tuna Recreational Fishery

The Atlantic Bluefin Tuna long considered the brute and bully of the deep-sea fishes is big, strong, elusive, and landing the fish posed a challenge. Corson (2007) appropriately

compared a hooked tuna as having "an insane elephant on the other end of the line" (p. D1). Elliott (2012) wrote:

> Tuna are incredible fighters. Battles of four, five, six hours are not uncommon. . .when it comes to delivering aching arms, jelly legs and a back that feels like it will never be normal again, the giant bluefin tuna is in a class of its own. (p. 22)

The largest tuna ever taken on rod and reel was 119 inches in length and weighed 1,496 pounds. The fish was caught by Ken Fraser in 1979 off of Aulds Cove, Nova Scotia (Anderson, 1990, p. 17).

The recreational fishery for Atlantic Bluefin Tuna actually began in 1911 when Commander J. K. L. Ross caught a 680-pound Atlantic Bluefin Tuna off of St. Ann's, Nova Scotia, Canada. The challenge and difficulty of landing such a large fish with the primitive fishing tackle and boats of the day increased the desires of humans to pursue the fish. Within a few years, as boats and fishing tackle were improved and new designs developed, humans were able to venture farther away from shore to pursue giant tuna. It was a time of little knowledge of migration patterns, spawning grounds, or habits. However, they did know the fish appeared in Nova Scotia in the late summer and early fall; there they were large and apparently, so the anglers thought, lazy. In time, research proved that the fish were larger there than farther south because they had been feeding all the way up the East Coast of the United States. They appeared to be lazy because the waters there were much cooler and shallower, providing less of an opportunity of escape. Angling success was intermittent because of the lack of equipment that was adequate to land the fish. However, this fact alone did not discourage pursuit; rather it fostered increased desire for conquest and further research and development on equipment.

In the late 1920s, anglers discovered large quantities of Atlantic Bluefin Tuna in the Bahamas during late May and early June. Unbeknown to them, they had discovered the southern leg of the migration from the spawning grounds in the Gulf of Mexico. The large quantities of large fish in both the Bahamas Islands and Nova Scotia led to the establishment of the recreational fishery. Since there was an abundance of fish and no market, catch quantities were not regulated and a "catch all you want" attitude prevailed. However, for the sake of perspective the quantities of fish being taken were miniscule compared to the size of the population at the time. Tournaments such as the International Tuna Tournament in Nova Scotia and the Cat Cay Tuna Tournaments became annual events, drawing anglers from all around the globe to those locations. It was not unusual to see hundreds of fish lain out on the docks and thousands of photos exist that chronicle wasted fish that can be measured in the tons.

Interest in fishing tournaments has always been high because they represented the epic battles where humans could fight and conquer a beast. As a result of the human desire to exert superiority over a beast and establish a champion among people, the most famous and significant of the big-game fishing tournaments began in the second half of the 1930s. The first major fishing tournament in the world was the International Tuna Cup Match held in 1937, and it would become an annual contest. The angler and author S. Kip Farrington, Jr. conceived the idea to have a tuna tournament located off of the Acadian village of Wedgeport, Nova Scotia, near the famous Soldier's Rip, which had become known as the tuna capital of the world. Crandall (1973) wrote that the purpose of the tournament was "bringing together teams of prominent sportsmen from all over the globe in an atmosphere of friendly competition and good fellowship" (p. 3). The rosters of these teams that competed in these early contests read like a "who's who" list of the angling world. In 1939, the tournament was suspended before it began

because of the war that was raging in Europe and it was not revived again until 1947. The tournament remains in place today; however, it does not have the same luster and prestige, nor does it foster the same excitement or quantities of tuna as in the early days.

The New York advertising tycoon Louis R. Wasey was one of the earliest visionaries to see the economic and publicity value of fishing tournaments. He had purchased the 2-mile long island of Cat Cay in the Bahamas Islands, British West Indies, in 1931. There he founded the Cat Key Club, which became a playground for the rich and famous (Cat Cay Brochure, p. 1). Wasey, himself an angler, became aware of the annual migration of the bluefin tuna and since Cat Cay was uniquely positioned on the edge of the Gulf Stream, he decided to host a tuna tournament there. The first Cat Cay Tuna Tournament took place in 1939. All of the anglers combined, in this first tournament, caught 62,222 pounds of tuna ("Life goes tuna fishing, 1939, p. 71). The tournament would go on to be an annual event and in 1941, after Pearl Harbor was attacked, the Cat Cay Tournament was suspended because of the war and it did not resume until 1948. The tournament does not exist today. Cat Cay is still a private island and exclusive enclave that has an 82-slip marina, small store, fuel sales, a small private airstrip, and a nine-hole golf course.

Conscientious anglers and some of the tournament committees began to be concerned about the fish caught during the tournaments where many thousands of pounds of fish were mostly discarded. The tournament organizers of the 1939 Cat Cay Tournament made an attempt to stem the waste by making provisions for the Coast Guard to transport the caught tuna to Miami to be distributed to those in need. Roman (1940) reported, "Under the supervision of the Community Chest, various local agencies were called to help distribute the meat." The U.S.C.G. Cutter *Mojave* delivered 3,300 pounds of tuna on the first day and made daily trips to Cat Cay

throughout the tournament. While noble in thought, the logistics of this activity were problematic because of the lack of refrigeration on the Coast Guard Cutter, adequate storage facilities, and an adequate distribution network.

As was the case of the Northern Cod, in time the quantity and size of the fish began to decrease. It must be noted, however, that the recreational fishery accounted for much smaller quantities of Atlantic Bluefin Tuna harvest than today's commercial fishery.

The Atlantic Bluefin Tuna Commercial Fishery

Fish have been sought to feed the masses for centuries and humans have sought methods to achieve better efficiency for the same amount of time. For centuries, humans have sought and exploited large and small tunas. Six major species of tuna, albacore, two species of bluefin, yellowfin, skipjack, and bigeye, compose 75% of the world's tuna catch and are the subject of all of the international tuna trade (Lane, 1976). Until late in the 20th century, the Atlantic Bluefin Tuna was typically not a targeted species and most of those caught by the commercial fleet were bycatch. Anderson (1990) wrote, "The bluefin tuna was, and still is, a significant bycatch of longliners" (p. 192). These fish were either discarded or sold for a few pennies per pound, typically used in dog and cat food until the early 1970s.

The most efficient manner in which to harvest large quantities of fish is through a net or purse seine. This method allows a school or group of fish to be surrounded with a net curtain, which is then drawn closed, not allowing escape. It is one of the oldest methods of large scale fishing practiced by humans. Industrial scale net fisheries first developed in the Mediterranean Sea in the 13th century (Pepperell, 2011). The first known purse seining for bluefin tuna was done in the Black Sea by fishers from Yugoslavia in 1929 (Whynott, 1995). Purse seining was

typically operated by manpower until the 1950s when large-scale mechanization took place, allowing bigger nets and subsequent larger hauls.

The tuna fleet of the United States began in California in 1903 (Lane, 1976). This fleet was assembled to harvest skipjack (*Katsuwonus pelamis*) and albacore (*Thunnus alalunga*) to supply the canning industry, which produced commonly known brands such as Chicken of the Sea®, Bumble Bee®, and Star-Kist®. This fleet was not concerned with the Atlantic Bluefin Tuna until late in the 20th century. Mather (cited in Safina, 1998, p. 69) wrote:

> When the seiners started. . .they'd make a set and get a hundred tons of ten-pound fish, about twenty thousand young bluefins. And, they were getting sets like that all of the time. They were catching almost everything they saw. . .A lot of fish were wasted because if a boat netted a hundred-ton school and only had room left for ten tons they would just drop the rest, which were already dead.

According to Roger Wilhouse, a tuna seiner, the Atlantic Bluefin Tuna fishery began to show the strains of the practice in 1968 (Anderson, 1990).

In August 1971, the commercial bluefin fishery in the United States was transformed when a purse seiner named Frank Cyganowski began cooperating with a Japanese fish company. Cyganowski entered Cape Cod Bay along with a Japanese freezer ship to which he "transferred his purse seiner's load of bluefin tuna. They were expertly frozen and shipped to Tokyo's Tsukiji market where they were sold. . . ." (Weber, 2002, p. 68). Efficiency in purse seining includes larger nets, synthetic materials, larger ships, and contraction of boat ownership into larger corporations. Figure 8 illustrates a typical purse seine boat and net.

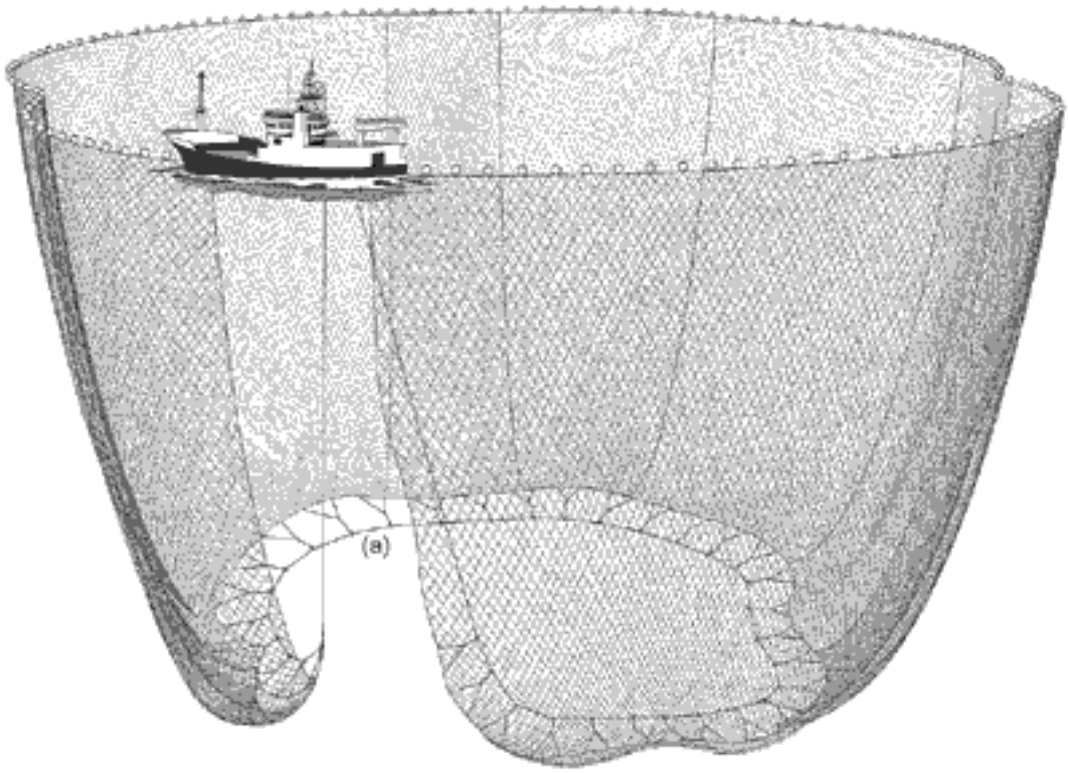

Figure 8. Depiction of a typical purse seine boat and net.

Adapted from The European Cetacean Bycatch Campaign, http://www.eurocbc.org/page371.html

Long lining is a widely employed and is a very efficient method of catch employed by commercial fishers worldwide to catch multiple fish at one time. Long lining creates a curtain of death because the baited hooks lay in wait until anything takes the bait or happens to get hooked while swimming in their path. Each line consists of 1 to more than 50 miles of hooks and line deployed. The long lining industry sets more than five million baited hooks every day (between 2 and 10 billion annually). Figure 9 illustrates the typical long line set.

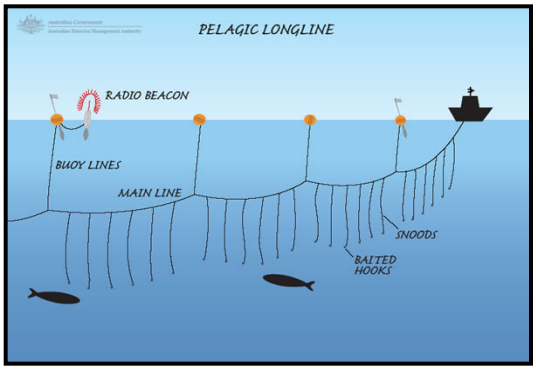

Figure 9. Typical long line set.

Adapted from the Australian Fisheries Authority, Photo No. X-Typical Long line set. Retrieved from http://www.afma.gov.au/resource-centre/teachers-and-students/about-fishing-methods-and-devices/longlines/pelagic-longline/

The largest drawback of long lining is the bycatch that results from the indiscriminate catch of untargeted species. Generally, bycatch is discarded and some estimates have placed the amount at 90%. Long lining is especially detrimental to birds, turtles, and the large pelagic species such as the Atlantic Bluefin Tuna. Long liner Captain Brigs Endt of the *F/V Catherine E* said in 1990:

> We had been fishing just off the bank of Hudson Canyon for three days, just after Thanksgiving. It was the third, or possibly the fourth section of gear, I am not sure which, and instead of yellowfin or big-eye we had a string of bluefin tuna. All of us in the industry know the longline quota on bluefin tuna was closed, happened back in July. . . we cut off a total of twenty-eight bluefin tuna from that section of longline. No way was I going to have any fish in my possession after closure of the fisheries. . .many of the fish, after being pulled to the topsides for identification, just settled away when cut

> off. A few of the fish showed some signs of life and may have survived. (cited in Anderson, 1990, p. 189)

The Atlantic Bluefin Tuna is also commercially sought by rod-and-reelers and harpoon fishers. This method of commercial fishing does not account for large numbers of fish because of the size of the boats, crews, and labor-intensive manner of harvest. Harpoon-and-keg gear fishing by small boats for surface-swimming bluefin tuna began in the 1930s. Commercial rod-and-reelers were popularized most recently through the National Geographic television series, *Wicked Tuna*. Both of these methods employ primarily artisanal or small independent fishers, as the large corporations prefer the efficiency of purse seines and long lines.

Tuna Farming and Ranching

In recent years, tuna farming has been developed in the attempt to satisfy the global demand of the bluefin tuna market. Primarily located in the Pacific Ocean and the Mediterranean Sea, tuna farming, or the more appropriate term—ranching—has extraordinarily undermined the species because the farms are actually fattening pens for captured wild fish. Usually constructed in the open sea, the farms hold youngster fish that are fed until they meet the market standard for size.

The tuna farms originated with the intent of preserving wild fish; however, the practice has developed into one of the most devastating causes of the sharp decline of spawning population because the farms are removing breeding stock from the wild. Tuna farming has become one of the largest industries in the global bluefin tuna business and because of tuna farming, the price of less desirable farm-raised sushi grade bluefin tuna has declined dramatically. The once uptown-exclusive bluefin tuna is now available to all Japanese consumers.

Other Ecological Factors

All marine species can be affected by both natural and human-induced changes to the ecosystem, ranging from the introduction of pollutants to invasion by foreign species. On April 20, 2010, the offshore drilling platform, Deepwater Horizon, exploded in the Gulf of Mexico. This disaster came to be known as the "BP Oil Spill." Eleven men lost their lives, 17 men were injured, and crude oil flowed unabated into the Gulf of Mexico at the rate of 53,000 barrels per day. Several months and 4.9-million barrels of crude oil later, the well was finally capped. The BP oil spill created an environmental disaster of mythical proportions, despite the efforts to collect and disperse the oil.

This spill took place at the epicenter of the spawning grounds for the Atlantic Bluefin Tuna. As of this writing, conclusive evidence on how the Western stock of the fish was affected is not known. However, questions will remain about the effect the petroleum dispersants, burning oil, and other factors resulting from this event had on the 2010 spawn or will have on subsequent generations. Earle (2009) wrote, "When tuna eggs and young go missing from the equation, what are the consequences, not just to the future of tuna, but to the fine-tuned ocean systems that have included tunas for millions of years?" (p. 68). Figure 10 displays the spawning ground area affected by the BP oil spill.

Today, the Atlantic Bluefin Tuna has become a targeted species because of the present-day popularity for its flesh. Through the centuries the Atlantic Bluefin Tuna became less desirable as a source of nutrition in many parts of the world as humans came to prefer seafood of lighter color and milder flavor. However, the characteristic that made it a less desirable fish for consumption, color and texture, was the driving force that created an entirely new market in the 20th century. Beginning in the 1970s, the sushi and sashimi market experienced unprecedented

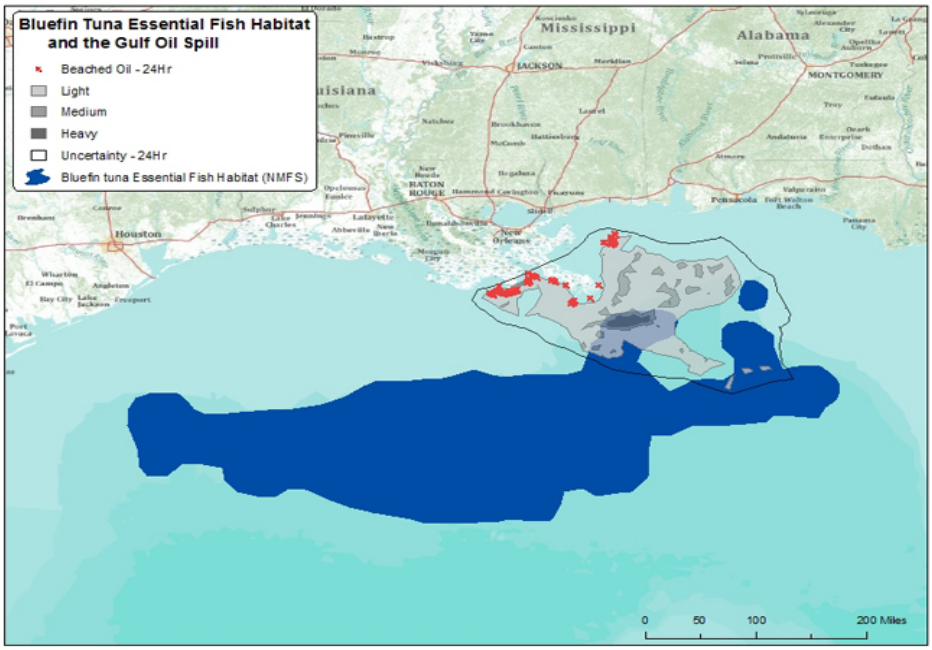

Figure 10. The Atlantic Bluefin Tuna (western stock) spawning grounds and the B.P. oil spill area.

Adapted from NOAA, http://www.dailykos.com/story/2011/01/19/937312/-Gulf-Watchers-New-Wikileaks-Embassy-BP-Russia-Cable-160-BP-Catastrophe-AUV-459

growth. This market brought new commercial fishing concerns to seek limited numbers of fish and has even turned recreational fishers into commercial fishers.

The Atlantic Bluefin Tuna Market

Today, the market for Atlantic Bluefin Tuna is concentrated in one country, Japan, where it is used to make sushi and sashimi. Each year Japan imports in excess of 400,000 tons raw fish to satisfy the demand of the sushi and sashimi markets alone. Of this amount, bluefin tunas are the most desired, hold the highest status, and are the largest single species quantities among all of the imports. The bluefin tunas account for 3% by volume and 10% by value among the imports (Whynott, 1995, p. 4). Today, 95% of the Atlantic Bluefin Tuna caught and harvested in the Mediterranean Sea is shipped to Japan (Issenberg, 2007, p. 245). However, the most desirable fish are those that are caught in the cooler waters off of the northeastern United States. Whynott (1995) wrote, "The jumbo bluefin of New England, because of its size, oil content, and color was most often the bluefin with the highest status of the Japanese market" (p. 4). The demand and the amounts of money paid for these fish have been very attractive to fishermen. Weber (2002), wrote, "Supplying the Japanese market for sushi-grade Atlantic Bluefin Tuna set off a race for the fish unlike any other in U.S. waters" (p. 68).

In Japan today "bluefin is the quintessential *maguro*—the food of perfection" (Whynott, 1995, p. 4). At one time bluefin tuna was considered to be *gezakana,* a "poor man's food" or "inferior fish," however, today the fish "has risen to *kokyu sakana*—high class fish" (Corson, 2007, p. 245). The prices paid in Japan for the fish have experienced astronomical growth in recent years. Prior to 1973, the price for bluefin tuna remained around five-cents-per-pound (Ulanski, 2008, p. 104). In 1973, aided in part by a strong yen and weak dollar, the price increased to one dollar-per-pound and the ensuing exponential growth in price was a direct result

of demand for the fish. By 1986, Japanese buyers began paying $12 dollars-per-pound directly to fishers, both commercial and recreational, on the docks as they arrived. In 1991, a single fish sold for $68,503.00—more than $100.00 per pound (Ulanski, 2008, p. 104). And, in January 2012, a single 593-pound bluefin tuna sold at the Tsukiji Market for a record $736,000.00 or $1,238.00 per pound ("Swank sushi," 2012, p. 1). Issenberg (2007) described the change in the market as "the hearty American supply of Bluefin and the ravenous Japanese demand for it had become liked. . .the tuna became the newest weapon in a complex joust between two newly linked allies, waged across lines of politics and economics" (p. 169).

Sushi is a Japanese finger-food composed of *shari*, a cooked and vinegared rice, combined with *neta*, another ingredient, fish being the most common. The neta and the manner in which sushi is presented may differ, however, the constant common component of all sushi is the shari. Issenberg (2007) wrote, "Culturally, sushi denotes a certain type of material sophistication, a declaration that we are confidently rich enough not to be impressed by volume and refined enough to savor good things in small doses" (p. 267). And:

> As it travels around the world, sushi has shown itself to be a food permanently in flux, remade since birth for its time and place. What sushi is has been defined as much by those who catch tuna as those who slice and serve it. (Issenberg, 2007, p. 161)

Further, Issenberg wrote, "More than any other food, possibly more than any other commodity, to eat sushi is to display an access to advanced trade networks, of full engagement in world commerce" (p. 267). See Figure 11 depicting the desirable sushi portions of the Atlantic Bluefin Tuna.

Sashimi is a Japanese delicacy consisting of fresh raw meat sliced into very thin pieces. While sashimi can be made of almost any meat, the most common and popular sashimi is made

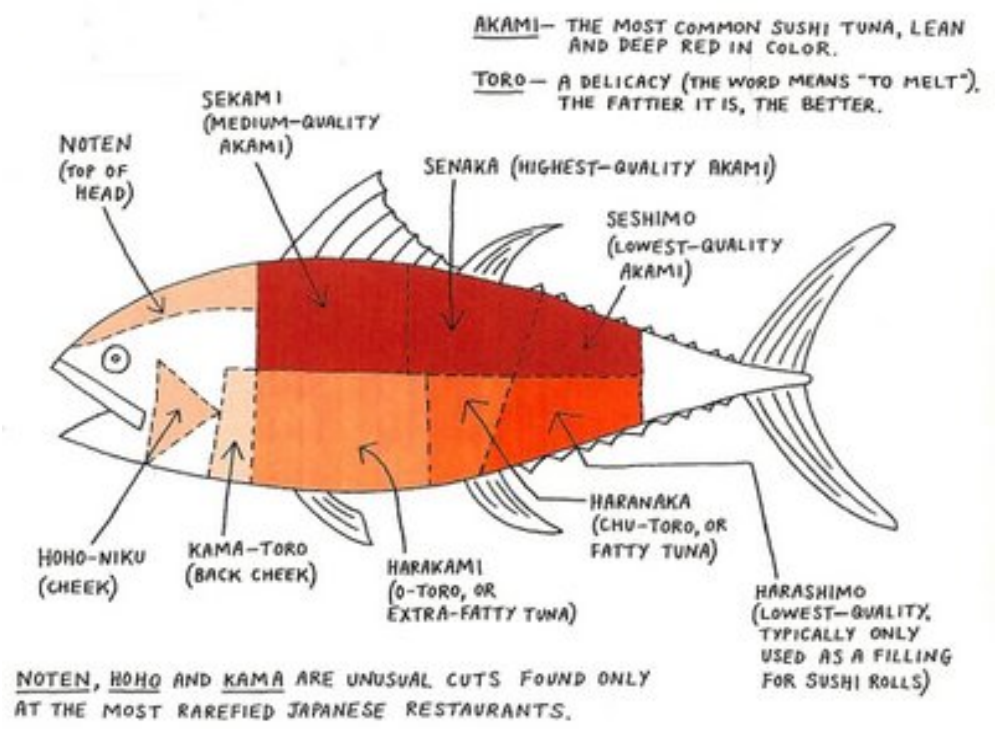

Figure 11. The sushi anatomy of the Atlantic Bluefin Tuna.

Adapted from http://www.Otoro.com.

from fish. For hundreds of years, both sushi and sashimi, in some form, have been popular in the Japanese culture. Ironically, prior to World War II, dark red meat was seldom used, the Japanese preferring the light-colored flesh of other animals and fish. However, as a result of the occupation of Japan by the U.S. military following the war, the Japanese developed a taste for beef and other dark meats (Corson, 2007).

The Japanese people have developed specific cravings and quality standards for their sushi and sashimi. As sushi and sashimi connoisseurs become more fastidious about their fish, the market shows elasticity and sensitivity based on the quality. Michael T. Carroll of Stop and Shop Supermarket Co., James L. Anderson of the Department of Environmental and Natural Resource Economics at the University of Rhode Island, Josué Martínez-Garmendia of J. L. Anderson Associates, Inc., explained the four basic attributes determining the value of fresh bluefin tuna by international traders, namely freshness, fat content, color, and shape of the individual (as cited in Carroll & Anderson, 2001, p. 247). The most desirable cut of the maguro is the fatty belly meat known as toro. The combination of white fatty streaks and pale pink flesh of the toro creates a unique buttery sensation, which is considered one of the "highest gluttonous gratifications and a status symbol in the Japanese culture" (Carroll & Anderson, 2001, p. 247). Corson (2007) wrote that in the early 19th century, "When *nigri* sushi was invented, the Japanese considered tuna such a low-class fish that not even street vendors would touch it. . .most people, commoners and aristocrats alike, would continue to disdain tuna for many more decades" (p. 66).

For decades, the Japanese were able to satisfy their demand for bluefin tuna through the Pacific Bluefin Tuna (*Thunnus orientalis*). However, four specific developments super charged the demand of Atlantic Bluefin Tuna from the Western Hemisphere: depletion of the Pacific

Bluefin Tuna fishery, airfreight, instant freezing techniques, and the expansion of the popularity of sushi beyond Japan.

The Pacific Bluefin Tuna fishery became depleted after many years of overharvest. As the fishery entered into decline, importers began to experiment with air transportation, allowing fresh tuna from distant waters to be readily available and accessible to Japan in the late 1970s. Although expensive, combined with the difficulty of maintaining the proper temperature of the fish, it was found the expense could quickly be recovered. The development of instant freezing technologies and sophisticated food storage technology further allowed for the fish to be transported to Japan from the East Coast of the United States. While freezing extends the longevity of food, the taste is almost often altered; however, by maintaining a constant temperature, the freshness and taste of bluefin tuna can be maintained. In 1991, the U.S. exported nearly 16 million in bluefin tuna to Japan by air (Longo, 2011).

Sushi and sashimi began to make its way across the Pacific Ocean to areas where those of Japanese descent were most prevalent. In short order, others began to embrace this new delicacy. Today, the sushi economy reaches almost every corner of the globe. Issenberg (2007) wrote, "It is now possible for an ambitious entrepreneur to open a sushi restaurant just about anywhere on earth, and nearly ten thousand of them have taken up the challenge across the United States" (p. 139).

The State of the Species

Humans have harpooned, netted, seined, trapped, long lined, rod and reeled, and hand lined the Atlantic Bluefin Tuna for centuries. The dead animal has been cooked, salted, dried, mounted, painted, and memorialized in many ways. And, scientists have studied, analyzed its behavior, and revered it as a marvel of nature. For centuries it appeared these fish were so

abundant that the supply was unlimited and would never end. However, today the species has arrived at a critical, some scientist say grave, place nearing the tipping point to collapse.

Today, population numbers of Atlantic Bluefin Tuna are down more than 90% since 1970 (Pepperell, 2011). Maggio (2000) wrote:

> Once they were numberless. The bluefin were to an ancient Mediterranean peoples what the buffalo was to the American Plains Indian: a yearly miracle, a reliable source of protein from a giant animal they revered, one that passed in such numbers that the cooperation of an entire tribe was needed to kill them and preserve their meat. (p. 10)

Mather wrote, "Once the price developed on the fish, sportfishing transformed into commercial fishing…There is practically no such thing as a sportfishing catch today with the exception of a few individuals" (cited in Anderson, 1990, p. 223). Anderson (1990) wrote:

> Today, more so than ever before, the ugly specter of greed and profit has come to strongly modify common attitudes as well as influence the future of the resource. How can there be any possible future for this resource when a single large fish is so valuable. (p. 42)

And, Slater (cited in Anderson, 1990, p. 90) said:

> The worst thing that ever happened was the high price that developed for the fish. I believe it caused everybody who was on the water, who liked to fish, to chase tuna to make a buck…without the lure of making a few bucks, these fellows simply quit fishing.

Inconsistent international public policies, unenforced regulatory efforts, and poor conservation attempts have resulted in the continued decline of the stocks due to overfishing. Greenberg (2010b) wrote:

> Perhaps people will never come to feel about a tuna the way they have come to feel about whales. Whales are, after all, mammals: they have large brains; they nurse their young and breed slowly. All of that ensconces them in a kind of empathic cocoon, the warmth

> of which even the warmest-blooded tuna may never occupy. But what we can perhaps be persuaded to feel, viscerally, is that industrial fishing as it is practiced today against the bluefin and indeed against all the world's great fish, the very tigers and lions of our era, is an act unbefitting our sentience. An act as pointless, small-minded and shortsighted as launching a harpoon into the flank of a whale. (p. MM28)

The magnificent Atlantic Bluefin Tuna has roamed the oceans for centuries keeping ecosystems in balance. Today, the same fish has become big business and the species sits at the tipping point of collapse. Between overfishing, environmental problems, and lack of proper regulation, this dissertation is timely in examining and evaluating the existing public policies surrounding the species.

Public Policy

The 21st century will be remembered as one of the most highly regulated eras in the history of the world. The natural resources of the Earth, land, air, bodies of water, all forms of life, including people, and institutions had some sort of policy created to govern behavior. Each person is touched by public policies that have been created through fiat, regulation, legislation, treaty, agreement, or law. Dye (1998) wrote:

> Today people expect government to do a great many things for them. Indeed there is hardly any personal or societal problem for which some group will not demand a government solution, that is, a public policy designed to alleviate personal discomfort or societal unease. (p. 2)

In the study of public policy, government, and politics the single common element that transcends all national borders is "good government often involves difficult choices" (Janda, Perry, & Goldman, 1998, p. 1). These so called difficult choices always produce either winners or losers, and sometimes only losers, depending on the choice in question. The original dilemma, and prime difficult choice, any government seeks to balance is the situation which

arises when freedom and order collide. Total freedom is the opposite of total order. Each increment of order is achieved through the infringement on an increment of freedom. Thus, the more a situation is regulated, the more a freedom is reduced. In societies governed by laws, this infringement takes the form of the public policies that the various levels of government establish. Schneider and Ingram (1997) wrote:

> For policies to have intended impacts on society, a large number of people in different situations must make decisions and take actions in concert with policy objectives. These actions may involve compliance with policy rules, utilization of policy opportunities, and self-initiated actions that promote policy goals. (p. 513)

What is Public Policy?

Public policy was defined by Klein and Marmor (2008) as ". . .what governments do and neglect to do. It is about politics, resolving [at least attenuating] conflicts about resources, rights, and morals" (p. 892). They further explained, from the "constructivist" (refers to the filters people place on their own realities to create order from the chaos) perspective, that problems policymakers grapple with are "the product of social and political perceptions" (p. 893). In order to understand government, the institutions must be analyzed as well as the interest groups operating in and around government. In the end, "governments are almost always engaged in a complex balancing act" (p. 894).

Harold D. Lasswell (1902-1978), an American political scientist, is known as the founding father of the study of public policy and the policy sciences (DeLeon, 2008). Lasswell wrote in the 1940s and 1950s seeking to create an "applied social science" to mediate between academics, governments, and citizens (DeLeon, 2008, p. 40). DeLeon effectively defines the characteristics of problem orientation, multidisciplinary, and value orientation to transcend the

individual disciplines that have attempted to study public policy in the past. These three factors clearly define the underlying principles of public policy and how policies should be developed. Further, DeLeon offers new approaches to improve the science of public policy. These new approaches are very valuable because, as he states, "stasis is hardly an option" (DeLeon, 2008, p. 53).

History of the policy making process provides the foundation to chart future policy research, evaluation, development, and implementation. Clearly understanding past decisions, at their formative juncture, provides the policymaker with the thought process, insights, and the events of that time when certain policies were established.

Winship (2008) clearly states that "conflicts over policy ends are ubiquitous," and each group or individuals have their own selected priorities and goals (p. 109). In order to satisfy the outcomes of each group, he proposes an "approach to policy analysis for dealing with multiple and conflicting ends" (p. 110). Rather than proposing "an elaborate theory," he uses games of fun, such as jigsaw puzzles, Scrabble®, crossword puzzles, and others, to make his points.

Forester (2008) explains the necessity in effective listening in order to learn about what the people are saying in the information-gathering phase of evaluation in order to properly diagnose the situation that a policy is attempting to rectify or regulate. He warns of the "danger of professional blindness" and challenges interviewers to use "practical rationality" and humor in their work (p. 125). The effective use of these skills will simplify the process and remove the barriers between those that are providing the information and those that are gathering the information.

Wilson (2008) wrote from the perspective "of a practitioner who has worked inside government departments. . .in a position of both giving and receiving advice" (p. 152). He went

into detail to explain what policy is and what it is attempting to do. Further, he drew distinctions between policy as an "objective" policy as "a guiding principle," and policy as a "specific action" to be taken to reach a goal. He explained his views from the British perspective and how politics and power enter into the arena with the various branches, departments, and agencies of government (Wilson, 2008).

In evaluating these varied approaches, while interrelated, each must be viewed singularly. Winship (2008) puts forward the games of fun as an effective example how to take an issue apart, like the pieces of a puzzle, to analyze the issue and develop a suitable policy strategy. This approach is very different from the approaches, such as cost benefit analysis, that have risen to prominence in public policy analysis. In essence, Winship stated that everything does not need to be "measured" to produce a result and his is "a process that is rational" (p. 119). The play metaphors are likened to Farmer's (2005) proposed concept of "Thinking as Play." Farmer (2005) explained that thinking in terms of "play" is "the escape route from the intellectual and performance doldrums of traditional governance" (p. 1). This strategy, as pointed out by both Winship and Farmer, is effective because it provides a new manner in which to view complex policy issues and their potential solutions. As Winship (2008) stated, "Discovering ways. . .in which disparate pieces may be put together" (p. 119).

Forester (2008) explained in detail the necessity for the interviewer to be able to collect clear information from a messy world. Further, it is important that the correct audience is being addressed in order to garner the appropriate perspective. This is a key point because, "To miss this local knowledge would assure our blindness to the particular cases in front of us. Listening only to the special knowledge of professionals, we might find ourselves generally correct but particularly, in this specific case, irrelevant" (Forester, 2008, p. 133). Once the appropriate

group is selected for study, the interviewer is challenged to gather his or her information without bias and with honest answers from the interviewee. This approach incorporates several aspects, from nonverbal communication to theoretical blinders.

Wilson (2008) provides an intellectually honest and realistic assessment of the policy process. He clearly states at the outset, "Policy in government is fundamentally about the exercise of power by the state" (p. 154). It is not a process that takes place in a vacuum, nor is it a process that takes place in a world where pure rationality rules the day. He describes policy as "the art of the possible" and the acceptance of analysis is dependent on "who carries it out and for whom" (p. 155). Most profoundly, Wilson states, "Policy analysis and policy advice are not only about the exercise of power *by* [emphasis added by author] governments; they are about the exercise of power *within* [emphasis added by author] governments" (p. 166).

What Should Public Policy Be?

From a theoretical perspective, public policy should establish the rules for society that cause the least amount of restricted freedoms for the most people. To view public policy and policymaking through a lens of what should or ought to be would embrace a philosophical position known as the *normative perspective*, *normative tradition*, or *normative ideal*. Fischer (1995) defined the normative ideal as "an abstract high-level value [or set of values], which serves to orient action" (p. 242). Klingemann and Wattenberg (1992) wrote that the normative principle of democracy was "the promotion of a particular form, organization, and philosophy of political life" (p. 140).

The difficulty of this position lies in John Stuart Mill's utilitarian ethical theory in which moral worth is determined solely by its usefulness in maximizing utility and minimizing negative utility. This position provides the root for the Kantian theory of the moral imperative, which

declares a certain action to be necessary or required. In 1785, Immanuel Kant wrote, "Therefore, every rational being must act as if he were through his maxim always a legislating member in the universal kingdom of ends" (Kant, 1981, p. 30). Kant was stating that people ought to act only by actions that would harmonize with a possible kingdom of ends. In other words, people have a duty to not create incoherent or impossible states of natural affairs when attempting to universalize solutions and to not act in a manner that leads to unstable or greatly undesirable states of affairs.

The normative perspective of policymaking would embody what Stone (2002) meant when she wrote, "Persuasion evokes images of reasoned and informed decision, what we can call the rational ideal" (p. 305). The rational ideal would not serve any one interest group's desires alone, "but do not serve anybody's interest, promote any value judgments, or exert persuasive force beyond the weight of their correctness" (p. 309). Stone further wrote, "The rational ideal, in sum, offers a vision of society where conflict is temporary and unnecessary, where force is replaced by discussion, and where individual actions are brought into harmony through the pervasive power of logic and evidence" (p. 305). However, people do not always act or make decisions in a rational manner, hence Kant's (1981) struggle to explain his idealist philosophy.

The normative perspective of policymaking where things should and ought to be and where individual actions are brought into harmony through the pervasive power of logic and evidence may be a panacea, however, it provides a new realm for possibilities. It may not provide a clearer goal, but it could clarify the process as Smith and Larimer (2009) described, "Normative theories [e.g., discourse theory, social constructivism] may not reveal universal truths—they assume there may not be any to reveal—but they can get us closer to understanding the different perspectives that underlie conflict in public policy arenas" (p. 18).

Every citizen has probably asked the question: Why don't policymakers just do the right thing? It is a good question, which has often been asked. Perhaps, the short answer involves, in democracies, policymakers are looking at the nation's problems from the perspectives that coincide with their election cycles. To risk alienation or to incur the wrath of a large financial supporter is to place the election in question since the primary imperative is to "gain office" and the second imperative is "to stay in office" (Klein & Marmor, 2008, p. 894).

The longer and more complex answer is that the policymakers are not looking at the world's problems from a generational point of view, nor are they fully considering what policies should or ought to be in the context of what is the right thing to do. The normative perspective is the standard to which legislators should be held because the answer to any problem the world may face does not lay in who wins and who loses. The collective answer to any policymaking process should be what is best for the world as a whole.

The Policymaking Process

Public policymaking is a never-ending process of persuasion that is directed from many different perspectives. All of the different parties engage in a process of trying to influence the others' thoughts, behaviors, and actions. Public policymaking may take on different appearances in the different government systems. Socialist and communist governments, such as Cuba, make policies differently than the liberal democracies, such as the United States. Further, when groups of nations of different political systems are brought together, like the United Nations, the process is further complicated. All forms, however, have some key elements in common, persuasion being a key element.

Persuasion, in part, is accomplished through conversation in which one party attempts to convince the other to lend support to or against an issue based on argument or some form of

evidence. Arnold (1990) wrote, "Persuasion involves creating, activating, or changing the policy preference of legislators, attentive publics, and (if necessary) inattentive publics" (p. 92). From an organizational structure standpoint, Moran, Rein, and Goodin (2008) wrote, "Persuasion lay at the heart of effective command" (p. 5). Therefore, what government does or does not do derives its power through a complicated legislative process that results from persuasion, which can be defined in different manners. One form of persuasion, and perhaps the most basic, involves the casting of a vote in an election by a citizen for a candidate or ballot initiative. For example, the ability to cast a vote is a right guaranteed to all citizens in the United States by the Constitution of the United States, a document that has undergone amendment and interpretation for 234 years. Suffrage as a right was not easily won; universal suffrage took almost 200 years to achieve, and today some continue to question whether all citizens have the freedom to cast a vote. Having the right to vote has a very different meaning than casting that vote—one is permission, the other is an action, to exert personal persuasion.

Another form of persuasion lay in the citizen's voice during the process of policy formulation and implementation. That voice should come with a historical perspective, rationality, and pragmatism. This collective voice is often described as public opinion or the national mood and is the call to action for persuasion. Kingdon (2003) wrote:

> The idea. . .the climate in the country, changes in public opinion, or broad social movements. . .these changes in public opinion are not confined to the policy communities. . .nor to the themes that float around in those communities. (p. 146)

In 1807, Thomas Jefferson, perhaps the greatest political thinker in U.S. history, wrote to Edward Tiffin, "The hand of the people. . .has proved that government to be the strongest of which every man feels himself a part" (Cappon, 1987). This type of persuasion may come in the

form of a letter to a congressman, an op-ed article submitted to a newspaper, attendance at a public hearing, a peaceful demonstration, and on the other extreme, a riot, insurrection, or armed rebellion. And, thus, the power of persuasion lay in the citizen's voice, most often leading to advocacy.

In the legislative process, persuasion is often manifested through the influence yielded by groups of citizens or special interest groups. The First Amendment to the Constitution of the United States in part states, "Congress shall make no law. . .abridging the freedom of speech . . .or the right of the people peaceably to assemble, and to petition the government for a redress of grievances." This passage gives people in the United States the right to exert their persuasion on any issue of interest that may come before them. When people choose to exercise this right to persuade for the passage or defeat of a piece of legislation, the action is called *lobbying*. However, lobbying is a much more complex process than having a persuasive conversation.

Lobbying can serve as a tool for the policymaker as well as the citizen because it includes researching and analyzing the legislation or proposal; providing up-to-date information on developments; preparation and presentation of information; arrangement of testimony for hearings; meetings with congressional staff and/or members of Congress or agency officials; attending congressional and regulatory hearings; coordinating with coalitions that have the same interest on the same issue; and even educating government officials, employees, and corporate officers on the ramifications and implications of the legislation and policy. In essence, this form of persuasion involves what DeLeon (2008) described through metaphors like "rowing versus steering" and "arguing versus bargaining" to explain how the policy process functions today (p. 46).

Lobbying is a legitimate and necessary part of the democratic political process in liberal democracies because the decisions and policies made by governments affect both people and organizations. Since no person has the ability to be an expert in all matters that come before the legislature or agency leadership, information must be provided to produce informed decisions. Legislators and public officials are not able to make fair and informed decisions without information from the broad range of interested parties. All sides of an issue should be explored to produce equitable public policy, and, ultimately, the goal is to have an impact on the policymaking process.

Issues arrive on the political agenda after a need is recognized. In the United States, a present day example is the need to change and reform to the nation's energy policy, one that will find the nation less dependent on fossil fuels that are imported from other countries. There is little disagreement that some sort of reform is needed; however, the difficulty of establishing such a policy arises when the discussions begin on how and what the reform should be. Some view oil dependence as an economic and national security issue. This position embraces the belief that should a major disruption in petroleum imports occur, the economy of the United States could be thrown into chaos, severely impacting the nation's ability to defend itself. On the other end of the spectrum lay those who believe the use of fossil fuels should be permanently eliminated and the nation subscribe wholly to a policy of sustainability. Both positions have valid arguments and ultimately the collective vision of energy independence. However, in the end, they both have very different goals.

As the issues become more complex, coalitions and interest groups can form to produce a louder voice. Birkland (2005) defined an interest group as, "A collection of people or organizations that unite to advance their desired political and policy outcomes in politics and

society" (p. 81). Interest groups can have a broad range of interests, representing many policy positions and ideologies. Harper (1974) wrote, "Statements of ideology must provide definition of that which is ambiguous to the social situation, give structure to anxiety and a tangible target for hostility, foster group feelings, and articulate wish-fulfillment beliefs about the movements power to succeed" (p. 171). Some interest groups can have a single-issue orientation where their efforts are focused only on a single defined position, to the exclusion of all other positions (e.g., pro-life groups). Other special interest groups are multi-issue oriented and may take up various causes affecting their membership (e.g., labor unions). Some have proposed productive and substantive suggestions and others have relied on misinformation, scare tactics, and even threats as a tool of persuasion for their position.

In the United States, the town hall meetings in the summer of 2009 concerning the passage of the Affordable Health Care for America Act (HR 3962) is a prime example of persuasion in the steady participation in the business of the nation by its citizens. Much of the participation, perhaps the most vocal participation, appeared to be by citizens who seemed uninformed, were not prone to rational discussion, or have a pragmatic thought process. Perhaps those were the people Fischer (1995) was describing as having "ideological commitments bear directly on otherwise pragmatic policy issues" (p. 201). Perhaps, Susskind (2008) offered the best explanation of their behavior, ". . .politeness breaks down when passions run high, core values are threatened, or the stakes are substantial" (p. 271). However their behavior is interpreted, those citizens were participating in the process. While some did not agree of their conduct, they were exerting their power of persuasion while participating in the business of the nation.

The founders of the United States sacrificed far beyond what has been asked of later day citizens when they made a mutual pledge of their lives, fortunes, and sacred honor to each other to release the nation from the tyranny of a monarch and guarantee future generations the right of persuasion in civic affairs. Each of them, through their actions, taught all citizens the definition of their steady participation in the business of the nation. The sacrifice was large for these men, some well educated—some not; some wealthy—some not. They were merchants, lawyers, doctors, educators, farmers, and other professions—all regular people, all citizens, and emblematic of today's America. The only guarantee they sought was that one day they would breathe free. The founders were successful in their quest and today not only does the nation breathe free, but its citizens are free to use our persuasive powers to influence the discussion and the legislation.

Much of the literature written on persuasion has been dedicated to assessing and critiquing the process. These assessments and critiques are as broad and complex as the policymaking process itself. The common thread that binds the literature on the issue of persuasion in the policymaking arena is money. The money comes from individuals, corporations, and special interest groups, each protecting what they deem essential. Maisel and Buckley (2005) wrote, "Money in politics is like water'—it finds its way through the cracks" (p. 162). Money buys access and access buys influence.

Perhaps it is naive to believe that the founders of the United States were not influenced by special interests and created the American system for noble purposes, and perhaps today's citizens view their work through different lenses than they do the work of today's elected representatives. The citizenry finds itself increasingly skeptical of the process in today's policymaking environment because answers to questions and solutions to problems seem to be

increasingly more elusive. Also, today's policymakers appear to be more self-serving and to be more influenced by those that stand to gain most by regulations or policy than those policymakers of the founding years. Sifry and Watzman (2004) wrote:

> You may not think about it much as you go through your day, but our campaign finance system, in which special interest cash governs who runs for office, and what they do (and don't do) once elected, touches nearly every aspect of our lives. (p. 1)

Alarmingly, those that wield the most power and ability to persuade are those with the largest available resources. In essence, "The bulk of the real money, donations of $200 or more, comes from an even tinier fraction of the country, just one quarter of one percent of the population" (Sifry & Watzman, 2004, p. 4).

Looking back at the previously stated policy example of energy policy, the following question arises: Why has the nation failed to achieve a policy for energy independence? The answer lay in the large oil companies, Exxon-Mobil, Texaco, British Petroleum, and others that spend millions of dollars to solidify their position, and protect the profit motive with the policymaking community. Consequently, investment and incentives in alternative fuels have been handicapped, while their own markets and tax structures are improved. For example, "Since 1995, however, Congress has refused to reauthorize the taxes on the oil and chemical industries—the source of more than $213 million in campaign contributions since 1989" (Sifry & Watzman, 2004, p. 116). And, that number continues to grow larger today. The end result being that "Big Oil" continues to persuade those in the policymaking process to their benefit while the nation continues down the path without a strategy to become energy independent.

Persuasion can play many different roles in the policymaking process and the list of positions and desires appears to be endless. Klein and Marmor (2008) wrote, "Policy making

takes place in a framework of established conventions and normative rules" (p. 895). This is a troubling statement because it brings together two concepts that at once seem to contradict each other. Placed in a framework of established conventions would imply business as usual, and normative rules would imply what should or ought to be according to those who have the greatest power of persuasion.

Policy Evaluation and Change

In order to make changes to existing public policy, the existing policies require evaluation, research, and the application of frameworks. Etzioni (2008) explained that policy research is employed to determine what the policy decision should be. He argued that "malleability" is the single most important variable of the process and for "promoting change" and defined the term as, "the amount of resources (including time, energy, and political capital) that would have to be expended to cause change in a given variable or variables" (p. 835). Therefore, it is essential for attitudes toward policy changes be malleable because problems that are solved through public policy do not fit into the neat and confined borders of scientific facts, questions, theories, or opinions.

Further, Etzioni (2008) stated, "Policy researchers must be more eclectic and include at least all of the variables that account for a significant degree of variance in the phenomenon that the policy aims to change" (p. 839). Etzioni provided an approach that is realistic because all problems that public policy attempts to change or rectify is not necessarily clear-cut and neat. Baron (1998) wrote, "People would have to be willing to accept the idea that some agreement is better than no agreement, even if it seems unfair and even if it threatens national and individual autonomy" (p. 39).

The Influences of the Policymaking Process

The balancing act as described by Klein and Marmor (2008) is most complicated in a Western-style liberal democracy where the two main concerns are being elected to office and once elected, remaining in office. Getting elected and remaining in office is a combination of how the candidate views and communicates the institutional, ideological, and historical perspectives to his or her constituency and ultimately satisfies the notion of self-interest.

Laws, regulations, programs, and policies are not created in a vacuum, they are established as a result of an action and money or resources play a significant role in the policymaking process. Baumgartner, Berry, Hojnacki, Kimball, and Leech (2009) wrote, "Resources are important to interest groups hoping to change policy, but even substantial resources do not guarantee a policy outcome" (p. 191).

Many perspectives can influence the policy-making process. In this dissertation, however, five areas have been considered: economics, conservation, science, business, and politics. Each has further ramifications complicating the process of formulation and enforcement. Baumgartner et al. (2009) wrote,

> Policy makers and organized interests frequently work in tandem to advocate policy goals that they both share. Each can do things the other cannot; officials within the government can set agendas, meet with colleagues, and so on. Organized interests outside of government often have more staff time available, the ability to do research and publicize findings, and the luxury of working on just one or a few issues at a time. (p. 195)

Economics is a social science that analyzes the production and distribution of goods and services. McConnell and Brue (1999) defined economics as, "The social science concerned with the efficient use of limited or scarce resources to achieve maximum satisfaction of human

material wants" (p. 3). The theory behind economics is choice through the rationality assumption. North (2003) wrote:

> The rationality assumption at its best says that people are consistent and logical maybe, but it does not say how people make choices in the face of enormously complex information, imperfect knowledge and imperfect feedback on the consequences of their actions. (p. 2)

Often, the world has been exploited in the name of economics. Economics is often confused with business, however they are not one-in-the-same.

From an economic development perspective, creation of profits can have numerous ramifications. For example, justification to install a wind farm off of the coast of Cape Cod, MA is the creation of jobs, investment, and energy independence. However, questions arise whether this policy is good for the surrounding environment or does the expenditure on this wind farm meet the goals without damaging the environment. This statement is not a judgment call for either position. Further, sound or growing economics does not mean that the environment has to be abused. Earle (2009) wrote, "A sound economy requires a sound environment; a sound environment requires a sound economy" (p. 198). Further, the economic justification for creating a policy does not necessarily meet the normative test offered by Kant (1981).

Too often in the 21st century the conservation perspective in policymaking is likened to some form of radical opponent of change. Conservation is a value that is shared by the entire political spectrum—liberal and conservative. At the heart of conservation is the concept of protection of life and environment in all forms—aesthetic, ethical, ecological. Conservation can include species-specific movements, such as Save the Manatees; resource specific movements, such as water conservation; or movements to save habitats, such as Save the Chesapeake Bay.

Conservation does not need to be at odds with other societal influences, rather it should be a component of responsible stewardship. Klein et al. (2008) wrote, "The need to strike a balance between biodiversity conservation and socioeconomic viability in protected-area design is evident" (p. 692).

In the 21st century, the natural resources in need of conservation exceed the resources available for the causes. Meyers, Mittenmeier, Mittenmeier, da Fonseca, and Kent (2000) wrote:

> The number of species threatened with extinction far outstrips available conservation resources, and the situation looks set to become rapidly worse1±4. This places a premium on identifying priorities. How can we protect the most species per dollar invested? This key question is at the forefront of conservation planning. . . . (p. 853)

The concept of conservation is not new, however, after many years of discussion and advocacy the situation may be direr today than ever before.

Science is the search for the truth and understanding. Kuhn (1996) wrote, "Normal science, the puzzle solving activity. . .is a highly cumulative enterprise, eminently successful in its aim, the steady extension of the scope and precision of scientific knowledge" (p. 52). The knowledge gained by science, also known as scientific knowledge, occasionally has been framed ideas, which have been presented in accordance with certain explicit values and assumptions. A scientific process is supposed to be designed in such a manner that the influence of values is minimized. This process is called a methodology. The adherence to a specific methodology minimizes subjectivity throughout the process of research is perhaps the largest distinction between the scientific and nonscientific research. Sullivan et al. (2006) wrote, "Scientists adhere to scientific methods and procedures, and their opinions and recommendations are valued by

society because of the meticulous observation, continual confrontation, and self-reflection they entail" (p. 3).

While science may be the search for the truth that does not mean that science is cherished in the policymaking world. At times it would appear that all the science is available and pointing in a certain direction, however, it is sufficient to change policy. Perhaps this stems from the fact that there will always be an element of uncertainty in all science. Sloan (2003) wrote, "Science without compliance leads to defiance" (p. 105). Further, Charles Groat, Director of the U.S. Geological Survey, in writing on restoring the Florida Everglades, observed that "[t]here's a lot of talk about sound science, but it doesn't seem to affect the high-level decision making" (cited in Sullivan et al., 2006, p. 21). Should a situation reach beyond a tipping point, often the science is then embraced and solutions sought. Kuhn (1996) wrote, "In both political and scientific development the sense of malfunction that can lead to crisis is prerequisite to revolution" (p. 92).

Business, also known as the private sector, is engine of the world economy. Businesses can take many forms, from large multinational publicly held corporations to the simple fishmonger on the street in a Third-World country. Business is typically involved in producing or bringing a product to market. It is the largest provider of employment to individual people. Business is most often identified with capitalism. Throughout the 20th century, business undertook a dramatic contraction in numbers of firms as businesses consolidated and purchased competitor and suppliers. Donaldson and Werhane (1996) wrote:

> Today the 1,000 largest U.S. firms account for over 70 percent of the sales, over 85 percent of the employees, and approximately 85 percent of the profits of all U.S. industrial corporations. Fewer than 150 corporations now hold the same share of manufacturing assets as did the 1,000 largest corporations in 1941. (p. 420)

Business interests, motivated by the profit motive, typically continue to expand markets in the short term, regardless of the long-term consequences. History is replete with examples of dwindling resources and the seeming inability or unwillingness to curb the expansion. Simply, these policies have not been intuitive and are beyond reason. Baron (1998) wrote, "In general, when policy goes against some intuition, such as support for autonomy, blame and mistrust of others can justify advocacy of other solutions. Either the facts are wrong or someone is doing something even more insidious" (p. 32).

Politics, especially partisan politics, has a way of tainting scientific opinions and assessments in ways many issue stakeholders cannot appreciate. For example, politics can, and often does, trump scientific consensus in international bodies and can influence assessments of imperiled species. Many scientists are often frustrated by the frequent interference and high-degree of magnitude by politics in supposedly scientific debates.

Klein and Marmor (2008) make their case clear that politics through their double imperative is the driving force of public policy. They are realistic when they state:

> Policy change is not only the result of windows of opportunity suddenly opening as the result of some upheaval in the economic or political environment. Policy change itself may open such windows by demonstrating that the previously unthinkable has become doable. (p. 904)

Their application of cross-national policy discussions adds a new dimension to the process of policy analysis.

Fisheries Policy

Fisheries policies are subjected to many of the same influences as other public policies, both good and bad. Throughout the world a troubling pattern is persistent surrounding how

fisheries policies are formulated and implemented. Weber (2002) wrote, "Until 1996, an ideology of abundance had prevailed. The biological sustainability of fishing was presumed and the goal of management was to ensure maximum use" (p. 198). This pattern combined with the inability or lack of motivation to practice restraint, good judgment, responsibility or sustainability has, and continues to allow the world's fisheries to decline. Ironically, in the end, effective public policies may be the last and best hope of preserving the world's oceans for the future.

Science has identified problems and established the compelling and alarming scientific facts surrounding fisheries' decline and collapse; however, the science is often ignored when policies are made. All of the science that is available has not been sufficient to engender any type of long-lasting significant fisheries reform and exposes the tension that exists between conservation and exploitation. Science has consistently presented ideas on how to slow the continued decline and how to restore many of the species that are imperiled. This advice has consistently been ignored, largely due to the uncertainty of science, or marginalized as policies have been formulated and implemented to maximize yield or profit. Safina and Klinger (2008) wrote:

> The reasons scientific advice is ignored include industry lobbying, inability of nations (or other political divisions) to agree on common goals for shared resources, and interference by politicians, such as congressional members who act on behalf of their constituents but in fact work against their constituent communities' long-term interests. (p. 245)

Further, Safina and Klinger (2008) wrote, "When the advice of scientists is not heeded, problems usually worsen, sometimes catastrophically. Fisheries managers are notorious for ignoring scientific advice, and this has caused problems for many fish species in, for instance, the North

Sea" (p. 245). This is not exclusive to the fisheries; other examples abound, including weather change, global warming, and others. Regardless, the burden of preserving the fisheries rests on the policymakers at many levels and in many countries to establish the policies that will reverse the current trends. Sutinen (2008) wrote, "Results show that competition for fishery earnings weakens the incentive to effectively lobby for regulations that maximize group well-being" (p. 2).

International policies concerning fisheries date to the 14th century when England and Castile (as Spain was known at the time) signed a bilateral agreement in 1351 (Mitchell, 2009). By 1875, more than 40 bilateral fisheries agreements were in place with a number of nations (Mitchell, 2009). All of the treaties revolved around which country had the rights to the fish in adjacent waters. Although these fishery resources were exploited, catch levels were low enough, due to inefficiencies in the system, that the fish stocks were not damaged beyond their natural ability to rebound. However, the philosophy and practice of resource exploitation was established and future generations would expand. Mitchell wrote in 2010, "Although most current international fisheries are plagued by collective over appropriation, the distribution of problems central to these early treaties continue to trouble international fisheries management" (p. 27).

The state of the world's fisheries has become increasingly important as indicated by the attention being placed on the issues surrounding them by international organizations like the United Nations, international trade unions, the execution of numerous bilateral and multilateral international treaties, and nongovernmental organizations and intergovernmental commissions, also known as Regional Fishery Management Organizations (RMFO). RMFOs include the Commission for the Conservation of Atlantic Marine Living Resources (CCAMLR), the

International Commission for the Conservation of Atlantic Tunas (ICCAT), the Commission for the Conservation of Southern Bluefin Tuna (CCSBT), the Indian Ocean Tuna Commission (IOTC), the Western and Central Pacific Fisheries Commission (WPCFC), the Inter-American Tropical Tuna Commission (IATTC), the Convention On International Trade In Endangered Species (CITES), and others. Each was created to address the complex issues surrounding the depletion of specific fisheries or areas. Today, more than 30 international commissions are charged with regulation of the world's fisheries (Mitchell, 2009). Some species are regulated by multiple agreements and others are regulated through trade by the World Trade Organization. Curiously, "Fisheries and species protection were the focus of eighty to ninety percent of all environmental negotiations until the 1950s but now constitute forty to fifty percent" (Mitchell, 2009, p. 28).

The central tenant to fisheries management and policy lay in ownership and the question: Who owns the oceans? Ownership is further complicated by those parts of the oceans that lay beyond territorial limits, exclusive economic zones (EEZs), and treaties—areas called the high seas. In short, "the open ocean beyond, the 'high seas,' belongs to no one—and everyone" (Earle, 2009, p. 247). Sixty-four percent of waters are beyond those that are claimed by any nation (Earle, 2009, p. 202). This problem of ownership was recognized and was of concern as early as the 1500s. In 1580, Queen Elizabeth I of England wrote:

> The use of the sea and air is common to all; neither can a title to the ocean belong to any people or private persons, for as much as neither nature nor public use and custom permit any possession thereof. (McGoodwin, 1990, p. 98)

Further, the situation has not changed and Earle (2009) wrote appropriately that, "It is largely a great blue free-for-all" (p. 202).

Few, if any, areas of natural resources management are more complex than the fisheries because the diversity of species, regions, cultures, national interests, and property rights. Ocean resources can be used up and resources used by some can deny use by others, hence, the tragedy of the commons. Fisheries policy fits very well into the Klein and Marmor (2008) definition that policy is the product of "what governments. . .neglect to do" (p. 892) because it is an issue that is typically not high on the agenda, does not garner large quantities of headlines, and is not a commonly discussed policy issue. It is not an issue that will get someone elected nor keep him or her in office. Sutinen (2008) wrote:

> Politicians tend to be shortsighted because they face short re-election cycles, of 2, 4, or 6 [in the United States] years. They are concerned about the consequences of policies and programs before the next election. The long-term consequences tend to carry little weight in the calculations of the politician. (p. 9)

However, fisheries policy is fundamental to human existence, the human food supply, and to the overall health of the world's oceans. The two major players in the international fisheries policy arena today are the United States and Japan.

Fisheries Policies in the United States

In the United States, fisheries policy is the responsibility of many agencies at the national level and by agencies and departments within each of the 50 states. In almost all cases, the fresh water fisheries are regulated by a different philosophy and by different agencies, laws, commissions, and departments than regulate the saltwater fisheries. Each agency has a unique mission; and often the agencies from the different levels of government appear to be at odds with one another.

Fisheries policies in the United States date to the winter of 1869-1870 with the perceived decline of the groundfish fisheries off of Massachusetts and Rhode Island. At the time, lower catches were being realized by the commercial fishers. There was a decline in catch, however, it was the result of an increasing number of commercial fishermen exploiting the resource, rather than a catastrophic decline in the population. No evidence ever surfaced to reveal the fishery suffered permanent damage. When called upon to intervene, the state legislatures of the respective states took little or no action. Spencer Fullerton Bird, the first curator of the Smithsonian Institution, adopted the issue of general fisheries decline (Weber, 2002). Bird authored a proposal, which was subsequently embraced and raised on the political agenda by Congressman Henry Davies of Massachusetts. This legislation ultimately led to the establishment of the U.S. Fisheries Commission under the auspices of the Smithsonian Institution. In 1887, the U.S. Congress established the commission as an independent agency (Weber, 2002).

Today, the U.S. government regulates the fresh water fisheries through the U.S. Fish and Wildlife Service (USFWS). This agency is housed under the U.S. Department of the Interior. The mission of the USFWS is clearly conservation as stated in the agency's motto, "Conserving the Nature of America" (USFWS, 2012). The saltwater fisheries adjacent to the United States, including the 200-mile limit, are regulated and policies enforced by 20 different federal agencies, the NOAA, being the most prominent. NOAA is housed in the U.S. Department of Commerce and its mission is "to understand and predict changes in Earth's environment and conserve and manage coastal and marine resources to meet our Nation's economic, social, and environmental needs" (NOAA, n/d). Meeting the nation's economic, social, and environmental needs is a much more complex mission that can lend itself to individual interpretation. Further, more than 140

different laws address the interrelated issues that affect the fisheries and cover ocean policy ("Blue fin tuna and CITES, 2009, p. 7). Some of the laws created decades ago are still used to regulate the fisheries in the 21st century, including some that set catch limits that exceed sustainable levels by 200% to 300%. Highlighting this complex multilayered policy approach in the 2011 State of the Union speech, President Barack Obama said, "The Interior Department is in charge of salmon while they are in freshwater, but the Commerce Department handles them when they are in saltwater. And, I hear it gets even more complicated once they are smoked."

The most serious attempt to regulate the saltwater fisheries in the waters of the United States was the passage of the Magnuson Fishery Conservation and Management Act of 1976 (MFCMA). The Act defined what type of commercial fishing activity could take place in the waters within 200 miles of the nation's shores, effective March 1, 1977 (Lane, 1976). This legislation was formulated and adopted as a result of the large quantity of foreign fishing vessels removing biomass from the waters of the United States. Further, at the time, the U.S. fishing fleet was small, had antiquated equipment, and not able to compete effectively. Consequently, the Act had two goals: (a) to modernize the American fishing industry, and (b) to conserve fish (Safina, 1998). It was reauthorized numerous times and in 1996 it became known as the Magnuson-Stevens Fishery Conservation and Management Act of 1996 (MSFCMA). One of the main provisions in the Act called for the establishment of eight regional fishery councils that were designed to allow individuals, who had knowledge and a stake in a particular area, to participate in the governance of that area's fisheries.

Each of the regional councils manage the fisheries in their designated area and establish the policies that include catch limits, fishing seasons, and closed areas. In theory, the concept is sound because each area is unique and people from a particular area, who have a stake, should be

the best informed on local issues and understand the particular characteristics and needs of the area. However, in practice the concept has not had all of the desired effects because many of those appointed to serve on these regional councils had, and continue to have, direct financial interests in the fishery harvest. This would appear to be in direct conflict with the intent of MSFCMA and may bring into question the rules of ethics. While some success has been realized, the most glaring fact that has become clear over the years is that these organizations have been either incapable, or unwilling, to react to the catastrophic decline of the fisheries.

Issues and problems have been identified, analyzed, and noted, however, unified and coherent public policies have not been implemented consistently. In spite of the shortcomings, "American fishermen. . .work under not only some of the world's most restrictive quota policies but a government that believes in aggressive enforcement" (Issenberg, 2007, p. 234). Presidents George W. Bush and Barack Obama have acknowledged some of the problems surrounding the state of the world's oceans; and in June 2009, President Barack Obama issued a proclamation that in part stated:

> My Administration…we are taking a more integrated and comprehensive approach to developing a national ocean policy that will guide us well into the future. This policy will incorporate ecosystem-based science and management and emphasize our public stewardship responsibilities. My Administration also is working to develop a systematic marine spatial planning framework for the conservation and sustainable use of ocean resources. I am committed to protecting these resources and ensuring accountability for actions that affect them. (Proclamation by the President of the United States, June 12, 2009)

In 2012, the United States took unprecedented action by placing catch limits on all of the 528 species managed by the national government. Eric Schwaab, Assistant Administrator for Fisheries at NOAA said, "It's something that's arguably first in the world. It's a huge accomplishment for the country" (cited in Eilperin, 2012, p. A-1). These steps, while important, necessary, and a beginning, will not have an impact in those waters beyond the U.S. EEZ or on the high seas.

Fisheries Policies in Japan

Japan has a long history and tradition of harvesting food from the sea. The Japanese people and the Japanese culture have ties to the oceans that precede the feudal era, or Edo Period (1603-1867) (McGoodwin, 1990). This tradition developed, in part, because of the limited land space in Japan available to harvest food. Once the waters of Japan teemed with enough quantities and different species to satisfy the demand of the population; however, today those same waters have exhausted their capability and the biomass required to satisfy the Japanese market no longer exists. In order to protect their own waters, the Japanese government declared a 200-mile EEZ in 1977 (Bergin & Howard, 1996).

To meet the domestic demand for seafood, especially high-value fish such as the tunas, the Japanese developed one of the largest distant-water fleets. Today, Japanese fishing vessels span the globe in search of large quantities of desirable fish. Bergin and Howard (1996) wrote, "Over the past decades Japan has dominated global fisheries" (p. 1). With the invention and development of flash-freezing technology, air freight, and larger vessels, the Japanese fishing industry has reached unprecedented levels of efficiency. Tokyo's Tsukiji Market is best known as the world's largest fish market and handles more than 2,000 tons of fish per day (McCurry,

2008, p. 6). Furthermore, while not a fishery issue, Japan is one of the only remaining countries that engage in whaling, to be used for both food and the oil.

The five factors used throughout this dissertation that influence public policy, economics, conservation, science, business, and politics, have similar effects on policymaking in both the United States and Japan. However, the fisheries lobby in Japan is much more powerful and has a more national scope of influence than in the United States. Maggio (2000) wrote, "The extraordinary power of the Japanese fishing lobby has even slowed down that country's space program" (p. 75).

In Japan, the prevailing view of conservation, often called "the environmental problem," is that it is the product of "western environmental groups" (Bergin & Howard, 1996, p. 121). Publically, Japan states the need and desire for conservation; however, in practice those measures are largely blocked or ignored. Japan has largely sought loopholes in the international treaties, such as seeking to establish joint ventures with other countries to use their partners' allocated quotas, blocking lower catch limits, and rejecting the science. Safina (1998) wrote:

> The Japanese have given Grenada and St. Vincent some longline boats designed to catch yellowfin tuna, and. . .Japanese advisors are on the islands instructing fishermen on how to handle the catch so it can be exported to Japan for sashimi. (p. 89)

In Japan, the ideas of best available science are not well-defined or are misrepresented when applied to fisheries management and policymaking. This causes confusion in the policymaking process. Sullivan et al. (2006) wrote, "But economic, social, and scientific limitations often force decisions to be based on limited scientific information, leaving policymaking open to uncertainty" (p. 1). Moreover, McGoodwin (1990) wrote, "In the final phases of establishing fisheries policies, political pressure is usually as decisive as bio-economic

concerns, a circumstance in which the advocates for one side or another more often confound the policy-making process than inform it" (p. 147).

Atlantic Bluefin Tuna Policy

Perhaps no other species has been more mismanaged by the greater world community than the Atlantic Bluefin Tuna. Effective regulation of the Atlantic Bluefin Tuna has been hampered by the various positions taken by the multitude of special interest groups, numerous countries, and commercial interests, ultimately resulting in public policy that has little unity or coherence. Although the species is managed by an RMFO and ICCAT, two of the most prominent countries defining bluefin tuna policy, especially surrounding the Western group, are the United States and Japan. Safina (1998) wrote:

> Probing for the truth to this debate requires following the bluefin, and the bluefin's trail leads us in many directions. It leads across and through oceans. It leads into a dense human jungle filled with shadowy figures, vine like tangles of crisscrossing agendas, and thickets of politics. (p. 8)

Barkin and Shambaugh (1999) wrote, "Once human populations grew and fishing technology began to improve by the middle of the twentieth century it became clear that international attempts to conserve these fish [tunas] stocks would be necessary" (p. 54).

Atlantic Bluefin Tuna Policy in the United States

The United States in large part, other than as a representative to ICCAT, is not engaged in management of the Eastern stock and is primarily concerned with the Western stock. The Atlantic Bluefin Tuna is a highly migratory species, therefore is managed in the waters of the United States by NMFS, a department of NOAA. Whynott (1995) wrote:

> In 1975 Congress enacted the Atlantic Tuna Convention Act, giving the Secretary of Commerce authority to carry out the recommendations of ICCAT, and this authority was in turn delegated to the Assistant Administrator of Fisheries, the Director of the National Marine Fisheries Service. (p. 143)

The United States is beholden to a quota issued each year by ICCAT. Anderson (1990) wrote, "Since the late 1970s, the prevailing scientific opinion suggests the United States should be fishing as near as possible to zero" (p. 28).

Atlantic Bluefin Tuna Policy in Japan

Today, the Atlantic Bluefin Tuna occupies the predominant position in the fisheries policies of Japan because of the value and quantity of its flesh consumed. McGoodwin stated, "One has to understand that the bluefin tuna is a commodity in Japan that has a certain status associated with it in terms of marketing, and is a delicacy for those who can afford it" (as cited in Anderson, 1990, p. 181). As a result, the fisheries lobbies in Japan have exceptional power in the policymaking arena.

The International Commission for the Conservation of Atlantic Tunas

The ICCAT is an intergovernmental fishery management organization charged with the responsibility of conserving the tunas and tuna-like species in the Atlantic Ocean and its adjacent seas. Today, ICCAT claims management authority over all tunas, marlin, swordfish and the other big fish of the Atlantic. Lane (1976) wrote, "The need for international management of tuna resources appears to be essential to the maintenance of stock levels. . .all nations involved in that area's tuna fishery [must] submit themselves to the dictates of the agency" (p. 34). And, the effectiveness of the organization has become increasingly scrutinized and reviled because the

organization has not been able to create consistent regulations to stop the continued and precipitous decline in numbers of certain highly migratory fish species.

The organization was created at a Rio de Janeiro, Brazil conference in 1966. After an approval process "the legally binding Convention was implemented in 1969" (ICCAT, n/d). The objective of ICCAT is:

> The governments. . .considering their mutual interest in the populations of tuna and tuna like fishes found in the Atlantic Ocean, and desiring to cooperate in maintaining the populations of these fishes at levels which will permit the maximum sustainable catch for food and other purposes. (Hurry, Hayashi, & Maguire, 2008, p. 1)

The original signatories included 17 countries; today 45 nations are included (the European Union is considered 1 nation) (Pepperell, 2011, p.20).

ICCAT has not been effective at managing the Atlantic Bluefin Tuna. This ineffectiveness results, in part, from flawed policies, the lack of proper information, enforcement power, and lack of punitive measures. Renton (2008) wrote:

> ICCAT, the International Commission for the Conservation of Atlantic Tunas, is an obscure - if you're not in the tuna business - Madrid-based organisation that spends some €2.3m (£1.8m) of EU taxpayers' money a year collating and commissioning scientific research, and holding meetings for the 45 nations with an interest in the tuna-type species in the Atlantic and Mediterranean. These include the US, Japan, China and the UK. If you work for ICCAT, it's a high air miles life: Tokyo in March, Florianopolis, Brazil, next month. This is all in the cause of conserving tuna, of course. Which ICCAT, all observers agree, has utterly failed to do. (p. 28)

In 2007, every member nation violated catch limits (Greenberg, (2010a). As a result, because of the continued declines of fish stocks, ICCAT commissioned an independent review, which said, in part:

> A simple reading of the state of the stocks under ICCAT's purview would suggest that ICCAT has failed in its mandate as a number of these key fish stocks are well below MSY. However, the Panel is of the view that rather than ICCAT failing in its mandate it

> is ICCAT that has been failed by its members (CPCs). Most of the evidence available to the Panel is that ICCAT has with a few exceptions, adopted in its basic texts and recommendations generally sound approaches to fisheries management. However this has been undermined by systemic failures by CPCs to implement such rules and recommendations ICCAT, as a tuna RMFO, has a sound base, it has done many things well and continues to do so, but it has failed against its objective because its CPCs have failed in their responsibilities to ICCAT and to the international community for the proper management of fisheries on fish stocks under the purview of ICCAT. (Hurry et al., 2008, p. 2)

Summary

The state of the fisheries is a very complex issue that involves many different factors that range from pollution to sport. Conservation and sustainability of the fisheries are essential to the survival of many people and are being addressed internationally and domestically through public policies that have little unity or are absent coherence. Birkland (2005) wrote that it was not sufficient to merely state a problem, "one must persuade others that the problem is real or that the problem being cited is the *real* problem" (p. 126). In applying these words, the policymakers must be persuaded that the decline of the fisheries is the problem. However, it has become increasingly apparent that other influences have precluded the policymakers from taking the appropriate action to establish a framework that would correct the problems that are dwindling the fisheries.

CHAPTER 3. METHODOLOGY

"Truth emerges more readily from error than from confusion."

--Francis Bacon

In the 21st century, public policy determines how the fisheries of the world are managed. Nations have placed emphasis on effective fisheries management measures; however, the evidence suggests that many of the world's fisheries continue to decline. While some successes have been achieved, it has been suggested that many fisheries are being managed to death. Various influences—commercial, social, and cultural—contribute to fisheries policies and many questions remain concerning the effectiveness of existing fisheries policies. One of the specific questions this dissertation sought to answer is: Why does the Atlantic Bluefin Tuna continue to decline? The answer to this question led to the answer to the research question of this dissertation: What public policies should be established to save the Atlantic Bluefin Tuna?

To answer these and other questions, a qualitative methods approach of research was employed in order to gather the necessary information. The issues surrounding the Atlantic Bluefin Tuna fisheries are complex and often difficult to interpret. To fully comprehend the issues surrounding how and why the Atlantic Bluefin Tuna, as a species, has arrived at its present state and design public policies which will save the species, it was necessary to design a study which would answer these questions. Information was gathered from numerous sources including, the social, cultural, political, environmental, and biological perspectives. Further, these data were gathered from the international perspective. The Atlantic Bluefin Tuna is the subject of a large volume of research available in the public domain; however, answering the

pertinent questions demanded of the public policy discipline and the act of policy formulation to design public policies to save the species required analysis through a specific research design method.

Research Design

The research design for this dissertation was based on the 5-component structure *interactive model* prescribed by Joseph A. Maxwell, Ph.D., of the Graduate School of Education at George Mason University, and explained in his book, *Qualitative Research Design: An Interactive Approach*. The information concerning the Atlantic Bluefin Tuna does not take a sequential or linear path, rather the inputs and feedbacks are often difficult to follow because of the complexity of each of the influencing factors. Maxwell (2004) wrote, "Design in qualitative research is an ongoing process that involves 'tacking' back and forth between the different components of the design, assessing the implications of goals, theories, research questions, methods, and validity threats for one another" (p. 3). The five components are as follows:

1. Goals.

a. Why is your study worth doing?
b. What issues do you want it to clarify, and what practices and policies do you want it to influence?
c. Why do you want to conduct this study, and why should we care about the results?

2. Conceptual Framework.

a. What do you think is going on with the issues, settings, or people you plan to study?
b. What theories, beliefs, and prior research findings will guide or inform your research, and what literature, preliminary studies, and personal experiences will you draw on for understanding the people, or issues you are studying?

3. Research Questions.

a. What, specifically, do you want to understand by doing this study?
b. What do you not know about the phenomena you are studying that you want to learn?
c. What questions will your research attempt to answer, and how are these questions related to one another?

4. Methods.

a. What will you actually do in conducting this study?
b. What approaches and techniques will you use to collect and analyze your data?
c. There are four parts of this component:
i. The relationships that you establish with the participants in the study
ii. Selection of participants, times, and places of data collection, and other sources such as documents.
iii. Data collection methods
iv. Data analysis strategies and techniques

5. Validity.

a. How might your results and conclusions be wrong?
b. What are the plausible alternative interpretations and validity threats to these, and how will you deal with these?
c. How can the data that you have, or that you could potentially collect, support or challenge your ideas about what is going on?
d. Why should we believe your results? (Maxwell, 2004, p. 4)

Following, Maxwell's 5-component interactive model research design structure is further explained.

Goals

This study was worth doing because the Atlantic Bluefin Tuna species is of global concern for numerous reasons including the biological place it holds as an apex predator in the marine ecosystem, the sociological place it holds in various cultures, and the economies of scale that have been created surrounding the desire for its flesh and as a source of nutrition.

The Atlantic Bluefin Tuna is an apex predator in the marine ecosystem. It is the largest member of the *Scombridae* family of fishes and like all of the scombrids, it is an open ocean predator (Rooker et al., 2007, p. 265). The scombrids play a key role in keeping the ecosystem in balance. All species compete for scarce resources and elimination of an apex predator can lead to an explosion of mesopredators, those next down the line. The cascading effect of predator loss could ultimately leave only those organisms at the lowest trophic level, able only to

sustain the most basic forms of life. This is a problem that is not exclusive to the marine ecosystem. William Ripple, Professor of Forest Systems and Society at Oregon State University, said, "This issue is very complex, and a lot of the consequences are not known…we are just barely beginning to appreciate the impact of losing our top predators" (Oregon State University, 2009, p. 1).

The Atlantic Bluefin Tuna has held a sociological place in various cultures for centuries. It fed the Roman Army, it has been sought by anglers for sport, and its image has graced art. In Japan, the flesh of Atlantic Bluefin Tuna is considered to be a delicacy and its consumption invokes an air of worldliness and sophistication. In the Mediterranean countries of Italy, Spain, Portugal, France, and Morocco, it has provided deep ceremony, pageantry, vocation for many, and the celebrations—the tonaras, the armaoes; the almandrabas, and the madragues—are a way of life.

The economies of scale that have been created because of the desire for its flesh have a broad range. Fishers of all types—seiners, long liners, rod and reelers, harpooners, anglers combined—spend millions of dollars each year on fishing tackle, bait, fuel, and other equipment in pursuit of the fish. On the consumer side, the fish supports wholesalers, retailers, freight companies, and a myriad of other businesses along the way. In the end, the spectrum between a hatchling fish and a diner's plate has almost endless ramifications and feedbacks. This dissertation examined the current public policies surrounding the Atlantic Bluefin Tuna, and the influences that contribute to all fisheries policies: economics, conservation, science, business, and politics. Each contributes to the policymaking process and to the policies themselves in unique and complex ways.

It is the hope of the author that this dissertation will influence the practices of effective global Atlantic Bluefin Tuna public policies. And, that this research and results promote future scholarship in the fisheries policy area. Further, I hope this dissertation will positively influence the process through which the policymaking bodies, management organizations, and enforcement agencies manage the Atlantic Bluefin Tuna.

I wanted to conduct this study because I was fortunate to grow up on the ocean and learn firsthand of the magnificence of its creatures. As the son of one of the pioneers of big-game angling, I experienced the ocean's creatures from a unique perspective. After a lifetime of preparation and dedication to public leadership, education, corporate stewardship, and volunteer community service on national, regional, state, and local levels, I seek to contribute to affecting public policies to help save the species. I endeavor to combine a lifelong passion and interest in the Atlantic Bluefin Tuna with the focus of my future life's work by returning to my roots, to the sea, and to the creatures inhabiting the sea to help chart the future, not just for the fish, but also for the billions of inhabitants of Earth. I plan to dedicate my next career to helping formulate policies that create winning scenarios for all peoples concerning the Atlantic Bluefin Tuna and that help this species recover from the threat of collapse.

People should care about the results of this study because it suggests a path, which if implemented, which will help save the Atlantic Bluefin Tuna, as a species, from collapse. The ramifications of collapse of any marine species are of global concern because little is understood about the balance that the various species bring to each ecosystem. Should the Atlantic Bluefin Tuna collapse, a broad range of ramifications could occur, including the loss of the biological place it holds as an apex predator in the marine ecosystem, the sociological place it holds in

various cultures, the economies of scale that have been created surrounding the pursuit and harvest of the fish, and as a source of nutrition.

Conceptual Framework

The Atlantic Bluefin Tuna has arrived at its present state primarily because of overfishing, removing fish from the ecosystem in a manner that is not sustainable. This practice has not changed in a positive manner and has followed the same trajectory for decades, regardless of the policies established or conservation efforts put into place. Today, the issues surrounding depletion of the species center on the financial rewards for the flesh of the Atlantic Bluefin Tuna, which have driven behavior that is beyond reason and beyond sustainability. Further, the flesh of the Atlantic Bluefin Tuna primarily satisfies one market—the Japanese *sushi* market. The flesh has become so valuable that exceeding quotas and illegal harvest have become the norm. To complete this study, I examined the policies, the policymakers, the fishers, the consumers, the science advisors, and subsequent steps in between that contribute to the current policies.

I chose two theoretical bases to guide and inform the research for this dissertation—complexity theory and public choice theory.

Complexity Theory

The world is a complex system with interacting and interrelated components, each providing one element required by the next. Complexity has numerous definitions "ranging from complex systems as more complicated versions of simple systems to complex systems as compounded systems, truly different from simple systems. . . ." (Teisman & Klijn, 2008,

p. 288). This theory provides a number of new approaches to the study of social, economic, political, and environmental systems (Manson, 2001). Therefore, this dissertation is rooted in complexity theory.

The issues surrounding the depletion and possible collapse of the Atlantic Bluefin Tuna are examined through the lens of complexity theory for two reasons. First, the species is an integral part of an extremely complex ecosystem, one where humans know more about the system than how all of the many components work together. Secondly, international public policy and policymaking, and the almost limitless viewpoints and influences that shape it, are rooted in a complex web of economics, sociologic, mores, beliefs, and customs. Each must be examined in order to establish a coherent policymaking process and policy itself.

Complexity theory is a relatively new and revolutionary method developed to explain any type of complex system, from multinational corporations to mass extinctions (Manson, 2001). Manson wrote, "Advocates of complexity see it as a means of simplifying seemingly complex systems" (p. 405). However, the actual practice of complexity theory is anything but simple.

Complexity theory is appropriate for this study because scientists and policymakers are typically specialists in their respective fields; therefore, the majority of their time is spent thinking, studying, and formulating solutions for that particular narrow segment of the world. Roberts (2012) explained, "Each pore over a fragment of the world, turning it over in his or her mind like a chip of some mosaic. . .impacts are discussed in isolation. . .by different people who never quite see the overall picture" (p. 6). And, Brodbeck (1962) wrote, "The multiplicity and complexity of factors in social phenomena impose limitations upon what we can reasonably expect to achieve. These limitations are only a practical, though perhaps practically insuperable,

difficulty and we simply do the best we can" (p. 47). Thus, the social sciences are complex and difficult to understand and interpret.

Public Choice Theory

The second theoretical basis for this study is public choice theory. It is an economic theory used to study problems that are traditionally in the discipline of political science and public policy. From the political science perspective, the theory deals with subjects where certain material interests dominate. Specifically, public choice theory is used to study the behavior of politicians, policymakers, and other government officials from the standpoint that they are self-interested players and how their self-interests apply to the system under the established constitutional rules. Public choice theory can be presented in different manners, but is most often used for normative purposes (what ought to be), to identify a problem or suggest public policies could be changed within the framework of constitutional rules and processes.

The issues surrounding the depletion and possible collapse of the Atlantic Bluefin Tuna are examined through the lens of public choice theory for two reasons. First, the species is an apparent integral part of an economic, business, and personal desire system where humans are not dependent on the species for survival; rather it is sought by choice to satisfy a personal desire. Secondly, in international public policy and the international policymaking arena, after all of the almost limitless study and scientific reports concerning the status of the species, policymakers have chosen to continue to harvest beyond sustainable levels. This choice must be examined in order to establish a coherent policymaking process and policy itself.

Public choice was of assistance in the explanation of Hardin's "Tragedy of the Commons," also known as the commons dilemma. Baron (1998) wrote, "In a commons dilemma, many people face the same pair of options: cooperation or defection. Defection

(fishing as much as possible) is better for each individual, and cooperation (restraint) is better for everyone else" (p. 23). This is a classic and common problem in the fisheries.

In order to understand the people and the issues surrounding the Atlantic Bluefin Tuna, current literature from the scientific, public policy, and policymaking areas were employed. This literature included governmental and regulatory reports, documents, and congressional bills. The current sociological area literature included reports from local, international, and popular media sources combined with in-depth studies of each from scholarly journals and books.

Personal beliefs and experiences concerning the species was the foundation for this study. The literature discusses the magnificence of the Atlantic Bluefin Tuna eloquently. Scientists, such as Carl Safina, have used lofty terms to describe the fish, such as "saber-finned warrior from another world" and "perfect master of its element" (Safina, 1998, p. 8). These descriptions are almost poetic and are accurate, however, they do not seem to do justice to the fish. The novelist Ernest Hemingway described catching an Atlantic Bluefin Tuna in 1922:

> It is a back-sickening, sinew-straining, man-sized job even with a rod that looks like a hoe handle. But if you land a big tuna after a six-hour fight, fight him man against fish when your muscles are nauseated with the increasing strain, and finally bring him up alongside the boat, green-blue and silver in the lazy ocean, you will be purified and be able to enter unabashed into the presence of the very elder gods and they will make you welcome. (Hemingway, 1967, p. 17)

These few descriptive examples about the Atlantic Bluefin Tuna, from different perspectives, while eloquent and beautiful in composition cannot capture the magnificence of the species. However, I believe, unless a person has experienced seeing the fish in its natural element, that person has not experienced all that life can provide. As previously stated, this

dissertation is not a treatise to eliminate taking or harvesting the Atlantic Bluefin Tuna, it is based on the belief that the fish can be harvested in a sustainable manner. With these thoughts in mind, hypotheses were developed to assist in answering the research question.

Hypotheses

To answer the stated research question and design a public policy that will correct the problems exposed by the literature, the Atlantic Bluefin Tuna species and the Atlantic Bluefin Tuna policies were examined through complexity theory and public choice theory. Hypotheses were developed under each category. In this dissertation the term hypothesis is not used in the more widely-understood quantitative/statistical sense, rather it is used as Maxwell intended the term to be used in qualitative methods study. Therefore, the hypotheses evolved and were further developed as the study progressed. Maxwell (2004) wrote:

> The distinctive characteristic of hypotheses in qualitative research is that they are typically formulated *after* the researcher has begun the study; they are 'grounded' in the data and are developed and tested in interaction with them, rather than being prior ideas that are simply tested against the data. (p. 69)

Maxwell (2004) justified how hypotheses are developed in qualitative study by writing:

> This runs counter to the view, widespread in quantitative research, that unless a hypothesis is framed in advance of data collection, it can't be legitimately tested by the data. This requirement is essential for the *statistical* test of a hypothesis; if the hypothesis is framed after seeing the data, the assumptions of the statistical test are violated. Colloquially, this is referred to as a [no pun intended] "fishing expedition"—searching through the data to find what seem to be significant relationships. However, qualitative researchers rarely engage in statistical significance testing, so that this argument is largely irrelevant to qualitative research. "Fishing" for possible answers to your questions is perfectly appropriate in qualitative research, as long as the answers are then tested against new evidence and possible validity threats. (p. 69)

For this dissertation, the independent variable is the management policies; the dependent variable is the behavior of anglers, fishers, business, and the fish themselves. This relationship will be

demonstrated in this manner because this is a public policy dissertation and all of the current public policies are species management strategies. Regardless of the state of the species, the policies remain constant, good or bad, effective or not. The species continues to decline regardless of the policy and is only affected by the behavior of the anglers, fishers, businesses, consumers, and the market.

The Atlantic Bluefin Tuna

The Atlantic Bluefin Tuna is a biological marvel and an iconic aquatic animal. It has been sought, consumed, described, studied, discussed, and mythologized for thousands of years. The global significance of the Atlantic Bluefin Tuna cannot be understated for a myriad of reasons, from its beauty to the consumption of its flesh, which has fed entire civilizations for centuries. Today, population numbers of Atlantic Bluefin Tuna are down more than 90% since 1970 (Pepperell, 2011, p. 87). This decline is due, in part, to poor conservation attempts; however, the decline is primarily due to overfishing. Anderson (1990) wrote:

> Today, more so than ever before, the ugly specter of greed and profit has come to strongly modify common attitudes as well as influence the future of the resource. How can there be any possible future for this resource when a single large fish is so valuable. (p. 42)

H_1. The future state of the Atlantic Bluefin Tuna species is in danger of collapse.

Atlantic Bluefin Tuna Policy

Effective management of the world's fisheries has been the subject of intense discussions, heated debates, and intractable controversy for decades. Weak, inconsistent, and ineffective public policies have resulted in the extensive exploitation of certain species, some to the point of collapse. Inconsistent international public policies and unenforced regulatory efforts

have made the Atlantic Bluefin Tuna one of the more abused and mismanaged species by the greater world community. Effective regulation of the species has been hampered by the various positions taken by the multitude of special interest groups, numerous countries, and commercial interests, ultimately resulting in public policy that has little unity or coherence. Safina (1998) wrote:

> Probing for the truth to this debate requires following the bluefin, and the bluefin's trail leads us in many directions. It leads across and through oceans. It leads into a dense human jungle filled with shadowy figures, vine like tangles of crisscrossing agendas, and thickets of politics. (p. 8)

H_2. There is a relationship between policy and fishing activity.

H_3. The current policy approach is failing and will eventually lead to a failed species.

H_4. Current management policy of Atlantic Bluefin Tuna is failing to maintain a sustainable population.

H_5. International policy makers are more interested in their respective constituencies' welfare than the welfare of the species.

H_6. Current public policy is not effective at governing the Atlantic Bluefin Tuna fisheries.

Research Questions

The specific research question for this dissertation is: What public policies should be established to save the Atlantic Bluefin Tuna? However, this study also sought to answer numerous other questions, including:

- Why is the Atlantic Bluefin Tuna so important?
- Why has the science been ignored?
- Is the species really in trouble?

- Is it possible to save the species from extinction?
- Is the species worth saving?
- What happens if no new policies are implemented?
- Is the international community capable of regulating a common resource?
- Is the public policy making process flawed?

I wanted to identify and understand all of the influences that went into policymaking surrounding the Atlantic Bluefin Tuna. In order to scale this study, the scope of the influences was limited to economics, conservation, science, business, and politics. Further, I wanted to understand why so much difficulty exists in the design and implementation of the policies. All of the questions posed are interrelated and range from questioning if the species is really in peril to attempting to determine what can be done to save the species from collapse.

Methods

The oceans of the world are complex systems, which allow for the Earth to function properly. Within these complex systems billions, perhaps trillions, of smaller complex systems operate ceaselessly. These are all natural functions that occur without, and in spite of, human involvement or influence. Public policies are equally as complex as the natural world because of all of the differing views, layers, ideologies, and beliefs that affect them. Everything governments do or do not do is a result of an influence from some sector. Network analysis was employed to determine that a relationship exists between nodes. The term *node* is used to identify the particular actors in a particular network. For example, one node could be the Atlantic Bluefin Tuna, a second node could be an angler, etc. The actors can be an individual (angler) or groups (commercial fishers). The nodes are viewed as the endpoints from where pathways begin, connect, or end.

Network analysis identified the relationships that existed among the different nodes, influences of public policy, and components of the ecosystem. Secondary data analysis (SDA) was employed to explain why those relationships exist. The gathered information was then placed in a framework for evaluation of present public policies (Fischer, 1995). The use of these combined methods and their respective results provided avenues for and from which appropriate and effective conclusions were reached and future recommendations were formulated.

Network Analysis

The world is comprised of countless combinations of complex systems, all interworking and interrelated. In order to deconstruct these systems for analysis, two different forms of network analysis were employed: ecological network analysis (ENA) and social network analysis (SNA). Emirbayer and Goodwin (1994) wrote:

> Recent years have witnessed the emergence of a powerful new approach to the study of social culture. This mode of inquiry, commonly known as 'network analysis,' has achieved a high degree of technical sophistication and has proven extremely useful in a strikingly wide range of substantive applications. (p. 1411)

Network theory has been used for a long period of time to establish corporate and affiliate relationships in the business and marketing fields. SNA has its roots in the 19th century with the philosopher, Auguste Compte (1798-1857), and later the sociologist, Emile Durkheim (1858-1917), who argued that societies were composed of interrelated parts and pieces. In the 1930s, Jacob Moreno (1889-1974) used their thoughts to create a "sociometry" that "provided a way of making this abstract social structure tangible" (Borgatti, Mehra, Brass, & Labianca, 2009, p. 892). The ensuing decades were witness to further refinements and modifications to the theory and the process across disciplinary boundaries.

Network analysis is a tool that when applied to different fisheries policy areas and different ecosystems is very useful. Like all policy areas, fisheries policy is complex, has many stakeholders, and interest groups that can have influence on the outcome. Hartley and Read (2009) wrote, "Network analysis enables the analysis and the governance performance monitoring to achieve these integrated, ecosystem-based management objectives" (para. 4).

Ecological network analysis description. The natural world is ever evolving and becoming more complex because of both natural and human induced influences. ENA is "a modeling technique used for understanding the structure and flow of material within ecosystems, and is most commonly used for evaluating food webs" (Dame & Christian, 2006, p. 332). This method of research is used to understand and quantify, among other elements, trophic structure and ecosystem organization. Dame and Christian (2006) wrote, "ENA has the potential to be a standard tool for ecosystem-based fishery management because it gives a manager the ability to evaluate an entire food web rather than address a single component" (p. 333).

ENA is a relatively new method of analysis, however, its acceptance is growing. It has been used by various governmental entities to study and address management issues. For example, the Atlantic States Fisheries Management Commission employed ENA to improve single species management methods; the South Atlantic Fisheries Management Council is using this method to determine *system-level* effects of fishing, and NOAA applied ENA to different ecosystem-based management approaches (Dame & Christian, 2006, p. 335). Further, ENA has been used by researchers on a range of species-specific management studies, from oysters in the Chesapeake Bay to the global decline caused by overfishing.

For this study the use of ENA was narrowed specifically to the Atlantic Bluefin Tuna. It was employed to understand the complexity of the species' life by mapping the cycle between

spawn to adulthood. All of the ramifications, while identified, were not followed because this is a study of public policy, rather than a biology study. The information that could be gleaned from following all of the feedbacks, while important, would provide information beyond the scope of this dissertation.

Social network analysis description. The world is ever evolving and becoming more complex in all facets, from nature to human society. Complexity as a science has emerged because scientists and social scientists came to realize fully that understanding a system would not be possible without the understanding of what influenced that particular system. In the social sciences, particularly in public policy and policymaking, the complete view includes the direct and indirect relationships between people, groups, and organizations. Each is subsequently influenced by additional unique factors. These relationships are also known as networks, which can be defined and explained in many ways. In 2009, Borgatti et al. wrote, "For social scientists, the theory of networks has been a gold mine, yielding explanations for social phenomena in a wide variety of disciplines from psychology to economics" (p. 892).

SNA has been used to better understand the complexity of the world in the social sciences by mapping the relationships that affect a particular issue including, but not limited to, business, societies, mores, and competitors. Serrat (2010) wrote:

> Social networks are nodes of individuals, groups, organizations, and related system that tie in one or more types of interdependencies: these include shared values, visions, and ideas; social contacts; kinship; conflict; financial exchanges; trade; joint membership in organizations; and group participation in events, among numerous other aspects of human relationships. (p. 28)

In 2009, Hartley and Read wrote:

> . . .exploring the pathways of information flow, the bridging function served by individuals or organizations in mitigating information flow, the resilience of networks to alteration, and the potential for new connections that can enhance coordination and integration. Network maps are created through survey, interview, and /or other measures of communication actions. (para. 2)

Like all policy areas, fisheries policy is complex, has many stakeholders, and interest groups that can have influence on the outcome.

SNA was employed because of its usefulness for understanding the complexity of the policymaking world, and to study the ties between the groups that influence public policies and the policymakers surrounding the Atlantic Bluefin Tuna. SNA treats relationships that are established in networks as interconnected actors or nodes that can be mapped and measured. A network is a collection or structure of nodes that are connected as a result of a relationship. These relationships can include vertical and horizontal patterns of exchange, flows of information that are interdependent and independent, lines of communication that are reciprocal, and others. However, SNA focuses on the ties and links between the nodes, rather than on the nodes themselves.

For study of public policy and policymaking surrounding the Atlantic Bluefin Tuna, a system includes the dynamics and interactions surrounding the networks that are created by the complex society when economics, conservation, science, business, and politics meet. Today, SNA is most fervently embraced in the United States by the national security organizations, including the intelligence gathering, communities, because of the detailed visual explanations it provides of interrelated and interdependent relationships. An example from this area is the

network that comprises the terrorist organization Al Qaida. In short, an SNA diagram can be compared to a complex organizational chart.

An SNA diagram differs from conventional organizational charts in that organizational charts are neat hierarchical structures that define a reporting structure and delineate formal lines of authority. The network diagrams that are created by SNA are free flowing and often bypass the formal lines of authority, however, they collect and analyze the data that defines the interaction. Borgatti et al. (2009) explained that as researchers developed their methods, network analysis tended to focus on the idea that subjects were embedded in "thick webs of relations and interactions" (p. 892). An example of an SNA network is illustrated in Figure 12.

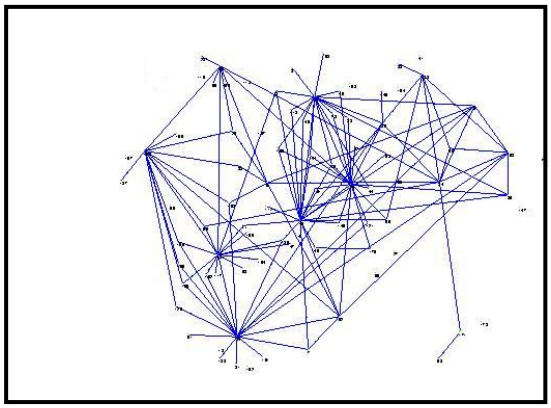

Figure 12. Sample SNA network.

Adapted from "Perspective Social Network Analysis and its Potential for Ecosystem Based Fisheries Management in the Chesapeake Bay," by T. Hartley and A. Read, 2009, http://www.mdsg.umd.edu/programs/policy/ebfm/update/sept09/

SNA application to fisheries policy. While physical and social science researchers view SNA from different perspectives, it is a useful tool in the research of fisheries policy because it may be used to understand the different influences that influence the policy decisions related to a particular fishery. Further, it is useful to shape how future policies should be designed and established because it provides a method to understand how the societal pressures can affect an

entire ecosystem. A fishery is a complex system that is influenced by many factors ranging from climate to pollution, amount of available food and predation, and human involvement. All of the societal factors that affect a fishery can be mapped through SNA to reveal the influences and how it is affected. SNA was used to understand established fisheries policies from the social science perspective. Hartley and Read (2009) wrote in their article of fisheries management in the Chesapeake Bay that SNA "is a new empirical tool for coastal and marine resource management, and as such the field and its specific application are evolving rapidly" (para. 4).

The formulation and application of just and effective fisheries policies in the collective international arena is interdependent and interrelated with those policies of each individual country because of the complexity of the global community. SNA was used to better understand the complexity of the fisheries policies of the world by mapping the relationships that are affected by business, societies, mores, and economics.

SNA would be a useful tool to explore and analyze many areas of fisheries policy because of the complexity Mikulecky (2001) described. It is almost impossible to see all of the interrelationships without the use of such a tool. In this study, network analysis was applied in the following manner:

- Identification of the network that was analyzed.
- Examination of the background information pertaining to the specific network to understand specific needs and issues.
- Definition of the scope of the analysis.
- Examination of the nodes in the network, which identifies relationships and flows between them.

- The use of a social network analysis diagram was employed to virtually map out the network.
- From the information gathered, design, develop, and implement public policy to bring about desired changes.

Disadvantages to use of SNA. SNA is not without detractors and critics. Borgatti et al. (2009) wrote, "Perhaps the oldest criticism of social network research is that the field lacks a (native) theoretical understanding—'it is merely descriptive' or 'just methodology'" (p. 893). Perhaps SNA is not high science or it is merely descriptive, however, the structure it provides is a useful framework to understand a particular system, and what affects that particular system. Emirbayer and Goodwin (1994) wrote, "Theoretical 'precursors' of network analysis have often been invoked in passing—especially [Emile] Durkheim and [Georg] Simmel—but network analysis, itself a constellation of diverse methodological strategies, has rarely been systematically grounded in the conceptual frameworks they elaborated" (p. 1412).

Secondary data analysis. SDA is "a form of research in which the data collected and processed by one researcher are reanalyzed—often for a different purpose—by another" (Babbie, 2010, p. 288). This method of research has been used widely and "has a rich tradition" (Frankfort-Nachmias & Nachmias, 2007, p. 276). SDA has been used by some of the most significant social scientists and researchers to reach their theories and corroborate their ideas. Examples include Karl Marx (1818-1853) and Emile Durkheim (1858-1917). According to Frankfort-Nachmias and Nachmias (2007), there are three reasons why the use of secondary data analysis is increasing—conceptual-substantive reasons, methodological reasons, and cost.

SDA has many advantages and includes fewer resource requirements, data collection that is unobtrusive, it can provide contextual data, and often the data can result in unforeseen

discoveries. In essence, SDA provides why the relationship exists. For example, it is a fact that Atlantic Bluefin Tuna flesh, especially the toro, is highly desirable by sushi connoisseurs in Japan. The why of the desire for toro is rooted in a number of societal beliefs, ranging from flavor to the appearance of sophistication and worldliness. There are five principle advantages of conducting SDA. First, if the information originally collected is accurate, there are opportunities to replicate the results. Secondly, the data that are collected in different periods of time provides the researcher the opportunity to use "longitudinal research designs" (Frankfort-Nachmias & Nachmias, 2007, p. 278). Thirdly, SDA expands the scope of the individual variables when major concepts are operationalized. Fourthly, in the use of SDA, the sample, representativeness, and number of observations can be increased, allowing for better generalizations. Fifthly, SDA can be used for triangulation, using data of different types to test the same hypothesis.

Disadvantages to use of SDA. SDA has a number of disadvantages, the most significant being "the data often only approximates the kinds of data that the investigator would like to employ for testing hypotheses" (Frankfort-Nachmias & Nachmias, 2007, p. 279). The original researcher may have had a completely different reason for conducting the research. Therefore, if a population is to be surveyed, the questions may have been worded in a different manner that the new researcher intended leading the responses to have a slightly different intent.

Secondly, access, the data previously collected may not be available or accessible. This is especially true if a private individual or organization holds the data. The organization or individual may not want the data reviewed publicly, especially if the data casts a negative shadow on them. Thirdly, insufficient knowledge of how the data will be collected. How data are collected often determines potential biases, errors, reliability, and validity.

SDA application to fisheries policy. Studies of the various species that inhabit the oceans and seas of the world have been conducted for centuries. These studies have ranged from their migratory patterns to their reproductive habits to their food sources. These studies have taken on a wide range of forms from tagging to direct observation to dissection. For example, the Atlantic Bluefin Tuna is on the edge of collapse for a number of reasons, most specifically because it has been harvested at unsustainable levels for almost a century. However, evidence relating to its decline suggests other factors may also be responsible.

The secondary data that were used in this study included books, reports, journals, articles, policy statements, planning documents, and archived research of fisheries legislation. Further, species-specific documents were secured though NOAA, International Game Fish Association, Mid-Atlantic Fishery Management Council, the Smithsonian Institution, university libraries, and other sources. Since these data were "collected and processed by one researcher…for a different purpose," they would be considered "secondary data" (Babbie, 2010, p. 306).

Validity

Validity in any study "is a goal rather than a product" (Maxwell, 2004, p. 105). According to Maxwell, the two primary threats to validity are bias and reactivity. Bias refers to the subjectivity of the researcher, which is often impossible to be completely eliminated. Maxwell (2004) wrote,

> Qualitative research is not primarily concerned with eliminating *variance* between researchers in the values and expectations they bring to the study, but with understanding how a *particular* researcher values and expectations influence the conduct and conclusions of the study [which may be either positive or negative] and avoiding negative consequences. (p. 108)

Reactivity refers to the influence the research has on the researcher. Reactivity is not a concern in quantitative research because of the controls that affect the variance. Maxwell (2004) wrote, ". . .eliminating the *actual* influence of the researcher is impossible and the goal in a qualitative study is not to eliminate this influence, but to understand it and use it productively" (p. 109).

How might your results and conclusions be wrong? Plausible alternative interpretations, and validity threats to these, could materialize. For example, the scientific world has established certain measures and facts concerning how the various fisheries existed in the past, including quantities and sizes of the fish that were a part of each. In-depth study continues on the fisheries as they exist now and extensive modeling continues to be performed in order to establish how they will be constituted in the future. Both present and past time periods include species identification, taxonomy, ecology, behavior, and methods for expansion of harvesting capacity. However, the information science provides is limited, including the measures and predictions, because of the level of uncertainty that arises from all scientific measurement.

The main shortcoming of evaluation involves the determination of what will be the original intent of the stated goal. Often an evaluation is being conducted on a policy decades after it was established with limited procedural and proceedings documentation. Original intent is often misjudged by individual determination of what is thought to have been the intent. Key questions include:

1. Why is the evaluation being conducted?
2. Where is the information coming from? (e.g., customers, board, management, staff, etc.)

3. What type of information is needed to make a decision or that is needed to understand the outcomes of the program? Whether it failed and why?
4. What are the sources from where the information should be collected? (e.g., customers, clients, and employees, program documentation, etc.)
5. Can that information be collected in a reasonable manner?
6. Timeline for collection?
7. What resources are required and available to collect the information?

The results of this study should be believed because sources from across the research landscape were used from scientific reports to empirical knowledge. This information can be considered rich data because it was varied and detailed to reveal a complex view of the policies, the policymaking, and enforcement landscape as related to the Atlantic Bluefin Tuna. Further, since the sources were varied, chance associations and systematic biases were reduced.

Data and Analysis

In this study, network analysis identified the existence of a relationship between actors and secondary data analysis explained why those relationships existed. The results were then placed into a framework for evaluation. Fischer (1995) provided a framework that "must always look in two directions, one micro, the other macro" to evaluate a public policy (p. 18). It is divided into two primary levels: First-Order Evaluation and Second-Order Evaluation. In First-Order Evaluation, the focus is "on the specific action setting of a policy initiative, probing both specific program outcomes and situational (or circumstantial) context in which they occur" (Fischer, 1995, p. 18). Second Order Evaluation is

> vindication and social choice. Here evaluation shifts to the larger social system of which the action context is a part; it focuses on the instrumental impact of the larger policy

goals on the societal system as a whole and evaluation of the normative principles and values underlying this societal order. (Fischer, 1995, p. 19)

Each level is further divided into two discourses. In the First-Order Evaluation, there is a Technical-Analytical Discourse that is quantitative and a Contextual Discourse that is qualitative. Concerning Technical-Analytical Discourse: Program Verification, Fisher (1995) wrote, "Verification is the most familiar of the four discursive phases" (p. 30). The goal is to place a quantitative assessment of the policy to determine its efficiency. Concerning Contextual Discourse: Situational Validation, Fischer wrote, "Validation focuses on whether or not the particular program objectives are relevant to the situation" (p. 20).

In the Second-Order Evaluation, there is a Systems Discourse that provides societal vindication and an Ideological Discourse that provides for social choice. Concerning Systems Discourse: Societal Vindication, Fischer (1995) wrote, "The basic task is to show that a policy goal (from which specific objectives were drawn) addresses a valuable function for the societal arrangements" (p. 21).

CHAPTER 4. DATA, ANALYSIS, AND INTERPRETATION

"The nature of coastal society is changing in ways it never has in this country for centuries, and in Europe for millennia…The consequences to the planet of the destruction of ocean life are terrifying. Scientists are increasingly worried by the loss of biodiversity. As more and more varieties of life disappear, it becomes increasingly difficult for the planet to sustain life" (p. 245).

--Mark Kurlansky, author of *The Last Fish Tale*

The world of the Atlantic Bluefin Tuna is complicated and often difficult to understand. The public policies surrounding management of the species have been vague and often contradictory. The influences that contribute to all fisheries policies: economics, conservation, science, business, and politics, contribute to the policymaking process and to the policies themselves in unique and complex ways. The objective of this dissertation was to analyze the public policies surrounding management of the species and design a policy that would save the species from collapse.

To gather the necessary information, the research design employed in this dissertation was based on the 5-component structure, interactive model prescribed by Maxwell (2004) in *Qualitative Research Design: An Interactive Approach*. The five components of Maxwell's model are as follows: (a) goals, (b) conceptual framework, (c) research questions, (d) methods, and (e) validity. Each of the questions that support each of the five components was answered before the study began.

Goals

It was important to conduct this study because the Atlantic Bluefin Tuna is a species of global concern for various reasons, from the biological place it holds as an apex predator in the

marine ecosystem to the sociological place it holds in national cultures, and the economies of scale that have been created surrounding the demand for its flesh and as a source of nutrition. It is the largest member of the *Scombridae* family of fishes and like all of the scombrids, it is an open ocean predator (Rooker et al., 2007). The scombrids play a key role in maintaining balance in the global marine ecosystem. All species compete for scarce resources and the elimination of an apex predator can lead to an explosion of mesopredators, those next down the line—in a lower trophic level. The cascading effect of predator loss could ultimately leave only those organisms at the lowest trophic level able only to sustain the most basic forms of life.

The Atlantic Bluefin Tuna has held a lofty sociological place in various cultures for many centuries, from feeding the Roman Army to the 21st century desire of conquest by anglers for sport. The economies of scale that have been created because of the demand for its flesh have a broad range, including: fishing tackle, bait, fuel, other equipment used in pursuit of the fish, wholesalers, retailers, freight companies, restaurants, and a myriad of other businesses. In the end, the spectrum between a hatchling fish and a diner's plate has almost endless ramifications and feedbacks.

People should care about the results of this dissertation because the collapse of any marine species is of global concern because little is understood about the balance that many species bring to each ecosystem. Should the Atlantic Bluefin Tuna collapse, a broad range of ramifications could occur, including the loss of the biological place it holds as an apex predator in the marine ecosystem, the sociological place it holds in various cultures, the economies of scale that have been created surrounding the pursuit and harvest of the fish, and as a source of nutrition. Further, this dissertation suggests a path, which if implemented, would help save the Atlantic Bluefin Tuna, as a species, from collapse.

Conceptual Framework

Today, the issues surrounding depletion of the Atlantic Bluefin Tuna center on a human behavior—overfishing—in the pursuit of a fish beyond reason and beyond the levels of sustainability. The flesh of the Atlantic Bluefin Tuna primarily satisfies one market—the Japanese sushi market. The flesh has become so valuable that exceeding quotas and illegal harvest have become the norm. Two theoretical bases guided and informed the research for this dissertation—complexity theory and public choice theory.

Complexity Theory

The world is a complex system with interacting and inter-related components, each providing one element required by the next. Complexity has numerous definitions, "ranging from complex systems as more complicated versions of simple systems to complex systems as compounded systems, truly different from simple systems. . ." (Teisman & Klijn, 2008, p. 288). This theory provides a number of new approaches to the study of social, economic, political, and environmental systems (Manson, 2001, p. 412). Therefore, this dissertation is rooted in complexity theory.

Complexity theory was appropriate for this study because scientists and policymakers are typically specialists in their respective fields; therefore, the majority of their time is spent thinking, studying, and formulating solutions for that particular narrow segment of the world. Roberts (2012) explained, "Each pore over a fragment of the world, turning it over in his or her mind like a chip of some mosaic…impacts are discussed in isolation…by different people who never quite see the overall picture" (p. 6). Brodbeck (1962) wrote, "The multiplicity and complexity of factors in social phenomena impose limitations upon what we can reasonably expect to achieve. These limitations are only a practical, though perhaps practically insuperable,

difficulty and we simply do the best we can" (p. 47). Thus, the physical sciences and the social sciences are complex and difficult to understand and interpret.

Public Choice Theory

The second theoretical basis for this study was public choice theory. It is an economic theory used to study problems that are traditionally in the discipline of political science and public policy. From the political science perspective, the theory deals with subjects where certain material interests dominate. Specifically, public choice theory is used to study the behavior of politicians, policymakers, and other government officials from the standpoint that they are self-interested players and how their self-interests apply to the system under the established constitutional rules. Public choice theory can be presented in different manners, but is most often used for normative purposes (what ought to be), to identify a problem or suggest public policies could be changed within the framework of constitutional rules and processes.

Hypotheses

To answer the research question and design a public policy that will correct the problems exposed by the literature, the Atlantic Bluefin Tuna species and the Atlantic Bluefin Tuna policies were examined through the lens of complexity theory and public choice theory. Hypotheses were developed under each category. Since this was a qualitative methods study, the hypotheses evolved and were further developed as the study progressed. This practice is typical and accepted in qualitative research.

For this dissertation, the independent variable is the management policies; the dependent variable is the behavior of anglers, fishers, business, and the fish themselves. This relationship was demonstrated in this manner because this is a public policy dissertation and all of the current public policies are species management strategies. Regardless of the state of the species, the policies remain constant, good or bad, effective or not. The species continues to decline

regardless of the policy and is only affected by the behavior of the anglers, fishers, businesses, consumers, and the market.

The Atlantic Bluefin Tuna

Today, population numbers of Atlantic Bluefin Tuna are down more than 90% since 1970 (Pepperell, 2001, p. 87). This decline is due, in part, to poor conservation attempts, however, the decline is primarily due to overfishing (Safina, 2003). Anderson (1990) wrote:

> Today, more so than ever before, the ugly specter of greed and profit has come to strongly modify common attitudes as well as influence the future of the resource. How can there be any possible future for this resource when a single large fish is so valuable. (p. 42)

H_1. The future state of the Atlantic Bluefin Tuna species is in danger of collapse.

Atlantic Bluefin Tuna Policy

Effective management of the Atlantic Bluefin Tuna fisheries has been the subject of intense discussions, heated debates, and intractable controversy for decades. Weak, inconsistent, and ineffective public policies have failed to prevent the extensive exploitation of the species. Inconsistent international public policies and unenforced regulatory efforts have made the Atlantic Bluefin Tuna one of the most abused and mismanaged species by the greater world community (Safina, 1998). The positions of special interest groups, certain countries, and commercial interests have hampered effective Atlantic Bluefin Tuna regulation. Ultimately, this has resulted in public policy that has little unity, coherence, or effectiveness. Safina (1998) wrote:

> Probing for the truth to this debate requires following the bluefin, and the bluefin's trail leads us in many directions. It leads across and through oceans. It leads into a dense

human jungle filled with shadowy figures, vine like tangles of crisscrossing agendas, and thickets of politics. (p. 8)

H_2. There is a relationship between policy and fishing activity.

H_3. The current policy approach is failing and will eventually lead to a failed species.

H_4. Current management policy of Atlantic Bluefin Tuna is failing to maintain a sustainable population.

H_5. International policy makers are more interested in their respective constituencies' welfare than the welfare of the species.

H_6. Current public policy is not effective at governing the Atlantic Bluefin Tuna fisheries.

Research Questions

The specific research question for this dissertation is: What public policies should be established to save the Atlantic Bluefin Tuna? However, this study also sought to answer other questions, including:

- Why is the Atlantic Bluefin Tuna so important?
- Why has the science been ignored?
- Is the species really in trouble?
- Is it possible to save the species from extinction?
- Is the species worth saving?
- What happens if no new policies are implemented?
- Is the international community capable of regulating a common resource?
- Is the public policy process flawed?

I wanted to identify and understand the influences that went into policymaking surrounding the Atlantic Bluefin Tuna. In order to scale this study, the scope of the influences was limited to economics, conservation, science, business, and politics. Further, I wanted to

understand why so much difficulty exists in the design and implementation of the policies. All of the questions posed are interrelated and range from questioning if the species is really in peril to attempting to determine what can be done to save the species from collapse.

Methods

To understand the complex systems from which the oceans are composed and the equally complex public policies that affect them, it was necessary to employ a network tool. Network analysis was used to determine if a relationship existed between different influences or nodes. The term node is used to identify the particular actors in a particular network. For example, one node could be the Atlantic Bluefin Tuna; a second node could be an angler. Further, the actors can be an individual (angler) or groups (commercial fishers). The nodes are viewed as the endpoints from where pathways begin, connect, or end. Secondary data analysis (SDA) was employed to explain why the relationships exist.

Validity

Validity in any study "is a goal rather than a product" (Maxwell, 2004, p. 105). According to Maxwell, the two primary threats to validity are bias and reactivity. Bias refers to the subjectivity of the researcher, which is often impossible to be complete eliminate. Bogden and Biklen (2007) wrote:

> The data must bear the weight of any interpretation so the researcher must continually confront his or her own opinions and predjudices with the data. Besides, most opinions and predjudices are rather superficial. The data that are collected provide a much more detailed rendering of events than even the most creatively prejudiced mind might have imagined prior to the study. (p. 38)

Reactivity refers to the influence the research has on the researcher. Reactivity is not a concern in quantitative research because of the controls that affect the variance. Glesne (2010)

wrote, “The credibility of your findings and interpretations depends on your careful attention to established trustworthiness. . .Time is a major factor in the acquisition of trustworthy data” (p. 151).

Data and Analysis

All research was conducted under the framework of complexity theory and public choice theory. In order to comprehend the Atlantic Bluefin Tuna fishery and the viewpoints that influence fisheries policy, facets of the regulatory environment and the natural science of the ecosystem were examined. The application of complexity theory was appropriate to frame this study because the world and its problems cannot be fitted into the neat and confined boxes of individual problems and individual solutions. Further, a simple approach that addresses individual problems will only provide partial truths. Individual problems are generally addressed by subject matter specialists that study narrow data sets, rather than as complex problems.

H_1. The Future State of the Atlantic Bluefin Tuna Species is in Danger of Collapse

The evidence reveals the world’s oceans in the 21st century have reached the limit of what they are capable of producing (Roberts, 2012). At the current rate of decline, the fisheries on which man depends will collapse by 2048 (Costello, Gaines, & Lynham, 2008). When the Northern Cod (*Gadus morhua*) fishery of Nova Scotia, Canada collapsed, a single province of a single country was affected severely; however, the predicted global collapse of 2048 will lead to problems that are beyond the realm of comprehension. Pollution, disregard for the environment, loss of habitat, catch methods, greed, and carelessness continue to be the norm; however, overfishing is the prime reason for the decline of the world’s fisheries.

All of the assembled data exposed overfishing as the prime reason the Atlantic Bluefin Tuna continues to decline as a species. The Atlantic Bluefin Tuna has been, and continues to be harvested from the ecosystem at rates that are not sustainable. History often provides clues to

future happenings. There are similarities between the present state of the Atlantic Bluefin Tuna and the collapse of the cod fishery; in particular, the policy positions and management decisions made by the regulating bodies. Other similarities include a declining age structure of the spawning stock and a reduction in number of eggs produced because of smaller stocks, and fishing activity.

Although a completely different species, both the cod and bluefin tuna have physiological similarities. They are both highly migratory, both eat herring, mackerel, and other schooling fish, and in both the quantity of eggs produced by the female are size and age dependent (Froese & Pauly). In the late 1960s, as fishing efficiency increased, the cod catch increased to a high of 800,000 metric tons (mt) (Hutchings & Myers, 1995, p. 74). The large quantities of biomass removed from the ecosystem combined with lax regulations led to marked declines in the stock. In 1973, the International Convention for the Northwest Atlantic Fisheries (ICNAF) established a management strategy based on maximum sustainable yield (MSY), the maximum quantity of fish that can be removed from the stock without affecting a species ability to replenish. MSY is a difficult measure to establish because an accurate stock size is difficult to ascertain for numerous reasons, including fish movement (Hutchings & Myers, 1995).

ICNAF established the size of the cod population on commercial catch data, and from that number erroneously established the MSY. Not taking into account improved efficiency of the fleet and the high catch numbers led managers to believe the stocks were much larger than they were in reality. Actually, the cod biomass declined 82%, from 2,961,000 mt to 526,000 mt from 1962 to 1972 (Hutchings & Myers, 1995, p. 74). The spawning biomass, fish large enough and old enough to breed, declined by 94% in the same period (p. 75). Hutchings and Myers concluded the cod's collapse was caused by (a) increased fishing effort, (b) increased fishing efficiency, (c) unachieved management goals, (d) errors in stock assessment, (e) overly

ambitious economic policy, (f) industrial greed, and (g) playing a minimal part, environmental factors (p. 80).

Hutchings and Myers (1995) wrote:

> Ultimately the primary reason for the collapse of the Northern cod was exploitation at fishing mortalities well in excess of levels at which the stock could have sustained itself. . .The commercial extinction of Northern cod off Newfoundland in the early 1990s was, and remains, an ecological disaster of extraordinary magnitude. (p. 82)

Not only are the two species similar physiologically, the collapse of the cod and the potential collapse of the Atlantic Bluefin Tuna have a number of similarities, specifically increased fishing effort, increased fishing efficiency, unachieved management goals, errors in stock assessment, industrial greed, and the reduction the average age of spawning females.

ICCAT was formed in the 1960s because of the increasing concern over declining tuna stocks in the Atlantic Ocean. Until 1974, ICCAT primarily operated as a research body, collecting data and occasionally issuing reports. At the time, there was a general lack of knowledge, understanding, and data on the Atlantic Bluefin Tuna, which hampered any potential management strategy. Between 1974 and 1996, ICCAT attempted to manage the Atlantic Bluefin Tuna fishery, however, it was not effective because of the organization's capacity to gather proper data and the lack of ability to compel countries to comply with any management strategy. Thus, incomplete and imperfect data and information was prevalent in the first three decades of the organization's existence. Beginning in 1996, through a strengthening of policies, true management of the species began. ICCAT began as a research organization and it took a long period of time to establish the realization that conservation and effective management was as essential function of the commission. This change in perspective was largely driven by the

United States and Canada as the Western stocks of Atlantic Bluefin Tuna continued to decline precipitously (Buck, 1995).

All of the data, including stock size and sustainability levels, is collected and compiled by the ICCAT Standing Committee on Research and Statistics (SCRS). The SCRS makes recommendations to the decision-making body, which in turn makes the policy. The SCRS continues to compile and refine data, resulting in today having a more realistic assessment of the stocks; however, much is still unknown. The information is constantly revised as evidenced by a review of the total harvest numbers published by the organization. Further, the SCRS is apparently still trying to establish an accurate baseline for the Atlantic Bluefin Tuna spawning stock. The latest report of the SCRS stated, "The updated assessment results indicated that the spawning stock biomass [SSB] peaked over 300,000 tonnes in the late 1950s and early 1970s and then declined to about 150,000 tonnes until the mid-2000s" (ICCAT, 2012, p. 83).

Overfishing has clearly decimated the Atlantic Bluefin Tuna population over time (Carlsson, McDowell, Carlsson, & Graves, 1998). Table 1 shows the last 25 years of available quotas, also known as total allowable catch (TAC), for both the Atlantic Bluefin Tuna of the Eastern stock (ABTE) and the Atlantic Bluefin Tuna of the Western stock (ABTW) and the respective reported total catch in metric tonnes for both. Webster (2009) wrote, "In fact, the total allowable catch plus national quota distribution system that is ICCAT's most common management tool evolved in the 1980s as a response to declining populations and harvests of western Bluefin" (p. 173). ICCAT did not implement the TAC measure until 1998; therefore, from 1987 to 1998 no quantities are included in the table.

Table 1 reflects the total reported catch as reported to ICCAT by the signatory countries. It does not reflect those catch numbers that result from transshipments, rogue nation fishing, and pirate fishers. These unreported catch numbers are an acknowledged worldwide fisheries

Table 1

Estimated Total Harvest of Atlantic Bluefin Tuna by Year (25 Years)

	Quotas and Total Catch According to ICCAT				
Year	Quota ABTE (TAC)	Actual catch ABTE	Quota ABTW (TAC)	Actual catch ABTW	Total catch mt
1987	n/a	18,220	n/a	2,503	20,723
1988	n/a	24,118	n/a	2,898	27,016
1989	n/a	21,161	n/a	2,759	23,819
1990	n/a	23,247	n/a	2,780	26,027
1991	n/a	26,429	n/a	2,921	29,350
1992	n//a	31,849	n/a	2,282	34,131
1993	n/a	32,268	n/a	2,368	36,636
1994	n/a	46,740	n/a	2,113	48,853
1995	n/a	47,291	n/a	2,423	49,714
1996	n/a	50,807	n/a	2,514	53,320
1997	n/a	47,155	n/a	2,334	49,989
1998	n/a	39,718	n/a	2,657	42,375
1999	32,000	32,456	2,500	2,772	35,228
2000	29,500	33,766	2,500	7,775	36,541
2001	29,500	34,605	2,500	2,784	37,390
2002	29,500	33,770	2,700	3,319	37,089
2003	32,000	31,163	2,700	2,306	33,469
2004	32,000	31,381	2,700	2,125	33,505
2005	32,000	35,845	2,700	1,756	37,602

Table 1 - continued

	Quotas and Total Catch According to ICCAT				
Year	Quota ABTE (TAC)	Actual catch ABTE	Quota ABTW (TAC)	Actual catch ABTW	Total catch mt
2006	32,000	30,689	2,700	1,811	32,501
2007	29,500	34,516	2,700	1,638	36,154
2008	28,500	23,849	2,700	2,000	25,849
2009	19,500	19,751	1,900	1,980	21,730
2010	13,500	11,328	1,800	2,857	13,186
2011	12,900	9,779	1,750	1,986	11,765
2012	12,900	n/a	1,750	n/a	n/a

Note. Adapted from Total Allowable Catch Data from the *Report of the Standing Committee on Research and Statistics* (PLE-104/2012). BFT-Table 1, pp. 87-89. International Commission for the Conservation of Atlantic Bluefin Tuna (October 1-5, 2012), p. 87-89.

problem; however, actual quantities are highly speculative. It has been estimated that illegal, unreported, and unregulated (IUU) fishing accounts for between 11 and 26 million tones per year globally (Agnew et al., 2009, p. 1). According to ICCAT, these fishing activities account for 3,000 to 4,000 tonnes per year, peaking in 2007 with an estimated catch at 61,000 tonnes (ICCAT, 2011). IUU fishing continues to be a major problem, further removing biomass from the ecosystem. Issenberg (2007) wrote:

> People have probably fished outside of the law for as long as governments have required anglers to declare their catch for tax purposes, but rapacious fishermen and cunning launderers have made the new black-market seafood commerce—illegal, unregulated, and unreported catches, or the trafficking of that product—into big business. These pirates may operate at the margins of the law, but they are not so much living outside the new global economy as thriving upon it. (p. 228)

IUU fishing complicates the data collection procedure and the integrity of the data itself because a completely accurate picture of the actual existing biomass in the ecosystem cannot be correct, therefore, causing difficulty in assessing the stock, forecasting, and the setting of TAC. Arnason, Kelleher, and Willman (2009) wrote:

> Illicit catches are frequently unreported—for example, fish under a legal size limit, or catch in excess of quota. The resulting inaccuracies in catch statistics are an important source of uncertainty with respect to scientific advice on fisheries management and the depletion of many stocks has been attributed partly to the inaccuracy of the historical catch data. (p. 26)

Concerning IUU, the October 2012 SCRS report stated:

> Projections are known to be impaired by various sources of uncertainties that have not yet been fully quantified. Although the situation has improved regarding recent catch, there are still uncertainties about…population structure, migratory rates, key modeling parameters for bluefin tuna productivity and the level of IUU catch (although the Group

> believed that the level of IUU has strongly decreased since 2008)… Acknowledging these limitations, the 2012 updated stock assessment confirmed 2010 findings, according to which the rebuilding of eastern bluefin tuna at SSBF0.1 level with a probability of at least 60% could be achieved by 2022 with catch close to current TAC (12,900 t) or 2010 TAC (13,500 t)**.** Current estimates indicate that the rebuilding could even be achieved before 2022, or slightly higher TAC may achieve the recovery by 2022. However, as the speed and magnitude of the rebuilding of the SSB remains highly uncertain, this outcome needs to be confirmed by future data and analyses. (ICCAT, 2012, p. 84)

Appendix B contains the complete record of catch data by year (1987-2011), area, fishing gear, and flag of fishing vessel (released October 2012 by the ICCAT SCRS).

As the stocks have declined, the spawning population has declined, as well. Atlantic Bluefin Tuna are size and age dependent for sexual maturity; the older and larger the fish, the more eggs that are produced. NMFS has predicted that the spawning population of the Western stock will collapse, assuming a catch level of 2,250 mt, by 2055 (NOAA, 2011, p. 86). Perhaps, the bleakest scenario, forecasted by the SCRS, is the probability that 500 adult Atlantic Bluefin Tuna will survive in both the Eastern stock and Western stock based on the current TAC of 12,900 mt and 1,750 mt, respectively. Tables 2 and 3 show the percentage probability of fewer than 500 Atlantic Bluefin Tuna will remain. For example, in the table a 0% indicates more than 500 fish will survive, and 82.5% indicates that there is an 82.5% chance that 500 or fewer will survive. While these are merely projections, the message is clear if catch rates continue to exceed TAC, the probabilities of continued and precipitous decline will continue to be a reality. In 1998, the SCRS reported:

> The projections indicate that future catch levels of 33,000 MT, or more, are not sustainable… Catches of 25,000 MT or less would halt the decline of biomass. It should be noted that even these results may be optimistic since they assume that future recruitment continues at the average level observed since 1981. (ICCAT, 1998, p. 59)

In 20 of the past 25 years, the 25,000 mt threshold necessary to halt the decline of biomass as stated by the SCRS was exceeded.

Table 2

Forecasted Probability That Fewer Than 500 Adult Atlantic Bluefin Tuna Will Survive in the East Atlantic by Year and Catch Level[a]

Catch mt	2010 (%)	2011 (%)	2020 (%)	2030 (%)	2040 (%)	2050 (%)	2060 (%)	2100 (%)
0	0	0	0	0	0	0	0	0
5,000	0	0	0	0	0	0	0	0
10,000	0	0	0	0	0	0	0	0
12,900	0	0	0	0	0.1	0.1	0.2	0.2
17,000	0	0	0	0.2	0.7	1.2	1.4	1.5
20,000	0	0	0	0.6	2.6	3.5	3.9	4.2
25,000	0	0	0	3.4	8.7	11.2	12.3	13.2
30,000	0	0	0	8.5	19.0	25.1	28.8	34.8
40,000	0	0	0.2	25.9	45.9	51.5	54.0	57.6
50,000	0	0	0.9	46.1	63.0	66.4	67.2	67.8
60,000	0	0	2.1	59.9	70.6	72.0	72.5	72.8
70,000	0	0	3.7	67.9	77.7	81.5	83.1	85.2

Note. [a] This assumes the high and low recruitment scenarios are equally plausible. Current management recommendations under ICCAT specify a total allowable catch of 12,900 mt.

Adapted from *Status review report of Atlantic bluefin tuna (Thunnus thynnus)*. (2011). National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Status Review Team, p. 91.

Table 3

Forecasted Probability That Fewer Than 500 Adult Atlantic Bluefin Tuna Will Survive in the West Atlantic by Year and Catch Level[a]

Catch mt	2010 (%)	2011 (%)	2020 (%)	2030 (%)	2040 (%)	2050 (%)	2060 (%)	2100 (%)
0	0	0	0	0	0	0	0	0
1,000	0	0	0	0	0	0	0	0
1,250	0	0	0	0	0	0	0.1	0.1
1,500	0	0	0	0	0.2	0.5	0.6	0.7
1,750	0	0	0	0.3	0.8	1.5	1.9	2.3
2,000	0	0	0	1.0	3.1	3.9	5.0	5.4
2,250	0	0	0	2.9	7.4	10.5	12.8	14.9
2,500	0	0	0.3	5.9	16.7	23.0	26.2	29.8
2,750	0	0	0.5	11.8	30.3	39.4	45.2	55.1
3,000	0	0	1.1	21.9	46.2	58.9	67.4	79.3
3,500	0	0	3.1	49.8	78.6	88.8	93.4	95.4
4,000	0	0	8.7	76.7	95.9	97.6	98.6	98.9
5,000	0	0	35.4	97.7	99.7	99.9	99.9	99.9

Note. [a] This assumes the high and low recruitment scenarios are equally plausible. Current management recommendations under ICCAT specify a total allowable catch of 1,750 mt.

Adapted from *Status review report of Atlantic bluefin tuna (Thunnus thynnus)*. (2011). National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Status Review Team, p. 92.

The oceans of the world contain many different pelagic apex predator species, including: sharks, billfish, tunas, swordfish, and others. The Atlantic Bluefin Tuna is unlike any other imperiled pelagic, apex predator species in part because of its unique biological systems and in part, because these fish are not solitary predators. They travel in schools, making them easier targets to find and harvest, providing the opportunity for larger numbers to be harvested at one time by methods such as large purse seiners. This practice is particularly harmful to the species when juveniles, those that have not reached sexual maturity or spawned, are taken. Therefore, the removal from the ecosystem can include thousands of tons of biomass at any particular moment.

Unreported catches, unflagged ships, nonselective fishing gear, and shear disregard for quotas continue to be the norm because of the market value of Atlantic Bluefin Tuna flesh. Until the international community adopts a policy that will regulate the consumer, such as a CITES listing or a policy similar to the newly adopted Billfish Conservation Act of 2012 (H.R. 2706) in the United States, futility at regulation may prevail. It is difficult to point towards the effective management of another imperiled pelagic, apex predator species because of the diversity of these animals; however, the successful management and restoral of the North Atlantic Swordfish may provide a model for the Atlantic Bluefin Tuna. Kuhn (1996) wrote, "Since no paradigm ever solves all of the problems it defines and since no two paradigms leave all the same problems unsolved, paradigm debates always involve the same question: Which problems is it more significant to solve?" (p. 110). Further, Kuhn wrote, ". . .crisis loosens the rules of normal puzzle-solving in ways that ultimately permit a new paradigm to emerge?" (p. 80).

Therefore, $\mathbf{H_1}$—The future state of the Atlantic Bluefin Tuna species is in danger of collapse—is upheld based on the analysis of NMFS, NOAA, and ICCAT. Unless dramatic

reductions in catch are established and enforced, the Atlantic Bluefin Tuna as a species is in danger of collapse.

H_2. There is a Relationship Between Policy and Fishing Activity

As established by **H_1**, the Atlantic Bluefin Tuna has arrived at its present state primarily because of overfishing—removing fish from the ecosystem in a manner that is not sustainable. This practice of biomass removal continues in an unsustainable manner and has followed the same downward trajectory for decades regardless of the policies established or conservation efforts put into place.

The primary driver of the public policies surrounding the harvest of the Atlantic Bluefin Tuna to date has been the business interests which are involved in all phases and levels of the Bluefin tuna industry. Business entities, individually and collectively, have used their influence to shape past and current policies. Baumgartner et al. (2009) wrote, "Resources help policy advocates in two ways. First, resources help policy advocates gain attention. . .Second, resources help policy advocates gain a better understanding of the political environment and the knowledge community in which they operate" (p. 226). Played out on the international stage, there has been an apparent inability for ICCAT to make public policies in a normative principled manner—the greatest good for the greatest number.

As the tipping point arrives for the oceans of the world, a new paradigm must be adopted. The species that live in the oceans are a natural resource, which can be harvested responsibly without upsetting the fragile balance of nature. The Atlantic Bluefin Tuna has an inherent value to the world's global fishing industries because of the number of individuals that benefit from the harvest of the fish. From the fisher to the end user, the fish supports many people. However, today it is the big corporations, such as Mitsubishi that are stockpiling tons of Atlantic Bluefin Tuna in freezers, that stand to receive the most benefit in the long run (Murray & Clover, 2009,

DVD). Figure 13 shows the relationship of the different influences on Atlantic Bluefin Tuna policy. Renton (2008) wrote:

> In fact, the commission is a joke: known in the business as the International Conspiracy to Catch All Tunas. Sergi Tudela, the World Wildlife Fund's head of fisheries for the Mediterranean, doesn't find it funny. 'ICCAT is a treaty, and some of its contracting parties pervert the spirit of it to ensure their overfishing of tuna continues,' he says. Roberts agrees. 'ICCAT doesn't do what it says it does - it doesn't conserve. Instead it presides over the decline and collapse of tuna stocks.' (cited in Renton, 2008, p. 28)

Fishery management organizations currently have few tools available to control harvest, namely quotas or TAC, which set the upper limits of the amount of fish that can be harvested and technical restrictions on fishing gears, seasonal closings, and size limits on fish. Other tools include fishing fleet capacity and the limitation of time at sea. These management methods are based on the best available science, including the size of fish stocks. Symes (1997) wrote, "When scientific advice has been refracted through the political process, it may appear to shed little light on the final decisions" (p. 146). ICCAT has repeatedly made policies based on the desires of the commissioners and managers, ignoring the advice of their own Standing Committee on Research and Statistics. Many ICCAT managers have strong fishing industry ties, calling into question ethical concerns. Jacobs and Page (2005) wrote, "The strongest and most consistent results. . .suggest that internationally oriented business corps are strongly influential in policy" (p. 9). Thus, in the case of the Atlantic Bluefin Tuna, ICCT has set TAC for the fish; however, one remaining concern is the level of allowable catch—is it too high?

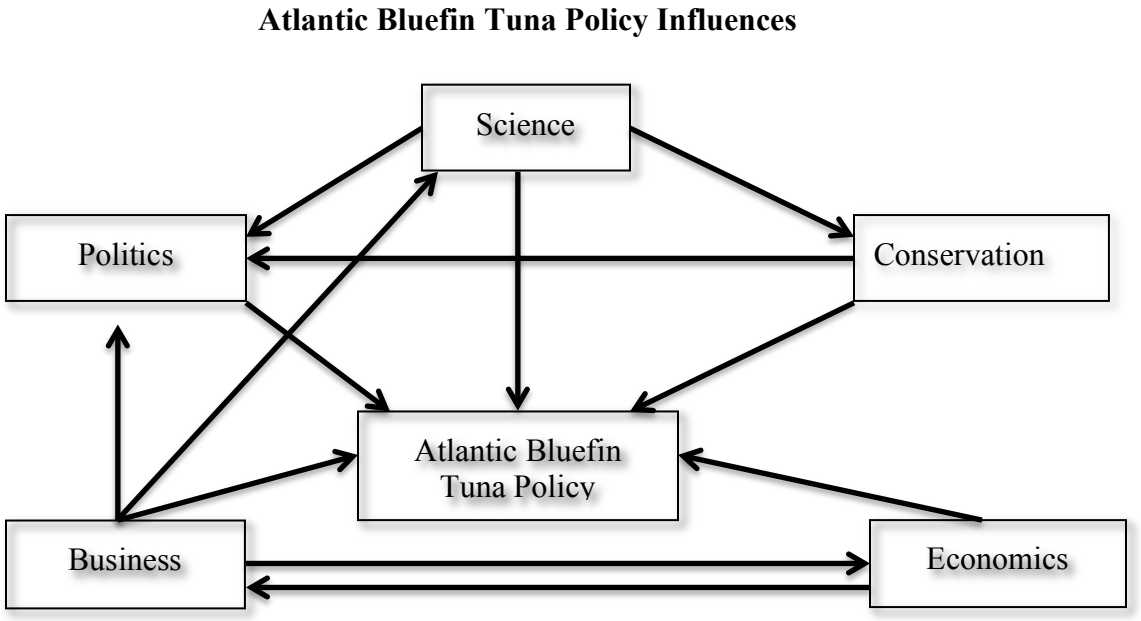

Figure 13. Influences of public policies surrounding the Atlantic Bluefin Tuna.

Prior to establishment of TAC, from 1978 to 1998, ICCAT reported 405,354 mt of Atlantic Bluefin Tuna catch. After ICCAT established the TAC measure, beginning in 1999, it has been exceeded seven times (numbers **bolded** in Table 4). In the 2 most recent years for which data are available, when the TAC has been at its lowest, the corresponding catch has been at its lowest, as well. This pattern seems to be more a function of declining stocks rather than because of the lower allowed catch limits. These figures do not take into account the pervasive problem of IUU fishing, which Charles Clover estimated at $25 billion per year (Murray & Clover, 2009, DVD).

In every case, the issues of the world's fisheries are well chronicled and all point to declining fish stocks. The prevailing and accepted paradigm has been increased efficiency instead of sustainability for the fisheries of the oceans. The fisheries of the world have arrived at a point of collapse; however, public policies have not adapted to the reality. Sustainability is the view that "annual replenishment will balance those that are removed, a process that can continue indefinitely as long as sufficient numbers remain to reproduce the next generation at a somewhat stable level" (Earle, 2009, p. 42). This replenishment-harvest relationship is more difficult to apply to long-lived species that reach sexual maturity after many years, such as the Atlantic Bluefin Tuna.

The world's fisheries are extremely complex and the management of those fisheries is even more complex. The one certainty is that the world's food chain will be forever damaged beyond repair if international bodies are not able to find a way in which to cooperate with one another. Perhaps most critical is that ICCAT has answered the question asked by this study itself. From the *Report of the Independent Review* of ICCAT (2009a, p. 2):

> A simple reading of the state of the stocks under ICCAT's purview would suggest that ICCAT has failed in its mandate as a number of these key fish stocks are well below MSY. However, the Panel is of the view that rather than ICCAT failing in its mandate it is ICCAT that has been failed by its members (CPCs). Most of the evidence available to

Table 4

Estimated Total Harvest of Atlantic Bluefin Tuna by Year (14 years)

Year	Quota ABTE	Actual catch	Quota ABTW	Actual catch	Total catch	Total quota	Variance between TAC and catch (mt)
1999	32,000	32,456	2,500	2,772	35,228	34,500	**+728**
2000	29,500	33,766	2,500	7,775	36,451	32,000	**+4,541**
2001	29,500	34,605	2,500	2,784	37,390	32,000	**+5,390**
2002	29,500	33,770	2,700	3,319	37,089	32,200	**+4,889**
2003	32,000	31,163	2,700	2,306	33,469	34,700	-1,231
2004	32,000	31,381	2,700	2,125	33,505	34,700	-1,195
2005	32,000	35,845	2,700	1,756	37,602	34,700	**+2,902**
2006	32,000	30,689	2,700	1,811	32,501	34,700	-2,199
2007	29,500	34,516	2,700	1,638	36,154	32,200	**+3,954**
2008	28,500	23,849	2,700	2,000	25,849	31,200	-5,351
2009	19,500	19,751	1,900	1,980	21,730	21,400	**+330**
2010	13,500	11,328	1,800	1,857	13,186	15,300	+2,114
2011	12,900	9,779	1,750	1,986	11,765	14,650	-2.885
2012	12,900	n/a	1,750	n/a	n/a	14,650	n/a

Note. Adapted from ICCAT. (2012, October 1-5). Report of the Standing committee on Research and Statistics (SCRS PLE-104/2012. Catch Data from BFT-Table 1, pp. 87-89. Madrid, Spain.

> the Panel is that ICCAT has with a few exceptions, adopted in its basic texts and recommendations generally sound approaches to fisheries management. However this has been undermined by systemic failures by CPCs to implement such rules and recommendations.

Table 5 shows the ICCAT major management timelines for the Atlantic Bluefin Tuna. Figure 14 provides a visual perspective of TAC and actual catch at each of the policy milestones.

Policy matters, however, it appears policy alone cannot modify behavior. Such was the case of ICCAT, it appears, especially in 2004 when countries began to make an effort to stay within the parameters established by the organization. Kuhn (1996) wrote, "Probably the single most prevalent claim advanced by the proponents of a new paradigm is that they can solve the problems that have led the old one to a crisis" (p. 153).

Therefore, **H_2**—There is a relationship between policy and fishing activity—is upheld. However, current policy can only regulate legal fishing activities until punitive policies for IUU activities are put into place.

H_3. The Current Policy Approach is Failing and Will Eventually Lead to a Failed Species

Decisions made by policymakers should be based on information concerning the condition or state of what they are attempting to regulate. Policy decisions are typically made to create winners and losers and they are not always made under Kant's (1981) normative principle—the greatest good for the greatest number. Concerning fisheries, Arnason et al. (2009) wrote, "Sustainable fisheries are primarily a governance issue and the application of the fishery science without addressing the political economy of fisheries is unlikely to rebuild marine fish wealth." (p. 53). Further, Martinez-Garmendia and Anderson (2005) wrote:

> The established fisheries management approach is based on an incomplete concept of conservation. Conservation of natural resources does not stop at maintaining a sustainable resource; it also comprises rationalizing its use. If the use of the resource involves

Table 5

ICCAT Atlantic Bluefin Tuna Major Management Actions by Year

Year	Management action
1974	• First minimum size established (6.4 kg. with a 15% tolerance for smaller fish).
1981	• Western stock bluefin tuna fishery closed: 800 mt quota for scientific purposes.
1982	• Increase Western stock TAC to 2,660 mt for 1983. • Prohibition on directed bluefin tuna fishing in the Gulf of Mexico. • 15% tolerance for Western stock bluefin tuna less than 120 cm fork length.
1991	• Eight percent tolerance for Western bluefin tuna less than 30 kg (115 cm)
1993	• Reduce Western quota to 1,995 mt for 1994, 1,200 for 1995. • Limit fishing in the Central Atlantic. • Prohibit long line fishing for bluefin tuna in the Mediterranean Sea during spawning months (June 1-July 31).
1994	• Prevent catch increases in East Atlantic and reduce catch by 25% starting in 1996. • Increase Western TAC to 2,200 mt for 1995.
1996	• Purse seine fishing prohibited in the Mediterranean Sea, August 1-31. • Prohibit catch of bluefin tuna < 1.8 kg. • Increase Western TAC to 2,354 mt for 1997.
1998	• First catch limits for East Atlantic and Mediterranean Sea (TAC = 32,000 mt for 1999). •Twenty-year rebuilding plan established for Western bluefin tuna; (TAC = 2,500 mt until 2018). • Prohibit catch of bluefin tuna < 3.2 kg. • Purse seine fishing prohibited in the Adriatic Sea, May 1-31; Mediterranean Sea, July 16-August 15.
2000	• Eastern TAC reduced to 29,500 mt.
2002	• TAC for Western bluefin tuna stock increased to 2,700 mt for 2003. Eastern stock TAC increased to 32,000 mt for 2003.
2004	• Prohibit catch of bluefin tuna < 10 kg. in the Mediterranean Sea.

Table 5 - continued

Year	Management action
2006	• Fifteen-year recovery plan established for Eastern bluefin tuna stock (TAC set at 29,500 mt for 2007, decreasing to 25,000 mt by 2010). • Purse seine closure extended to July 1-December 31. • Minimum size raised to 30 kg. • Spotter planes prohibited.
2007	• Eastern stock fishing nations encouraged to submit implementation plans for 2006 recovery plan for review by ICCAT. • Stock enhancement research promoted. • Catch documentation scheme adopted to track individual fish from catch to consumer.
2008	• Western stock bluefin tuna rebuilding plan was revised (TAC reduced to 1,900 mt for 2009, and 1,800 mt for 2010). • Rollover of under harvest limited to 10% starting in 2010. • Eastern stock bluefin tuna recovery plan was revised (TAC reduced to 22,000 mt for 2009, decreasing to 18,500 mt for 2010. • Spawning area purse seine closure extended to June 15-May 15. • New measures to reduce capacity and improve compliance.
2009	• Eastern stock bluefin tuna recovery plan was revised (TAC reduced to 13,500 mt). • Spawning area purse seine closure extended June 15-April 15. • New measures to reduce capacity and improve compliance.
2010	• Western stock bluefin tuna rebuilding plan was revised (TAC reduced to 1,700 mt.). • Rollover of under harvest capped at 10% of base quota. • Mexico and others were added to the allocation key, giving them a dedicated quota share. • Eastern stock bluefin tuna recovery plan was revised (TAC reduced to 12,500 mt). • New measures to reduce capacity and improve compliance.

Adapted from The Tag-A-Giant Foundation. (n/d). *International fishery management of Atlantic Bluefin Tuna*, p. 1.

Comparison of TAC and Catch with ICCAT Major Management Timelines

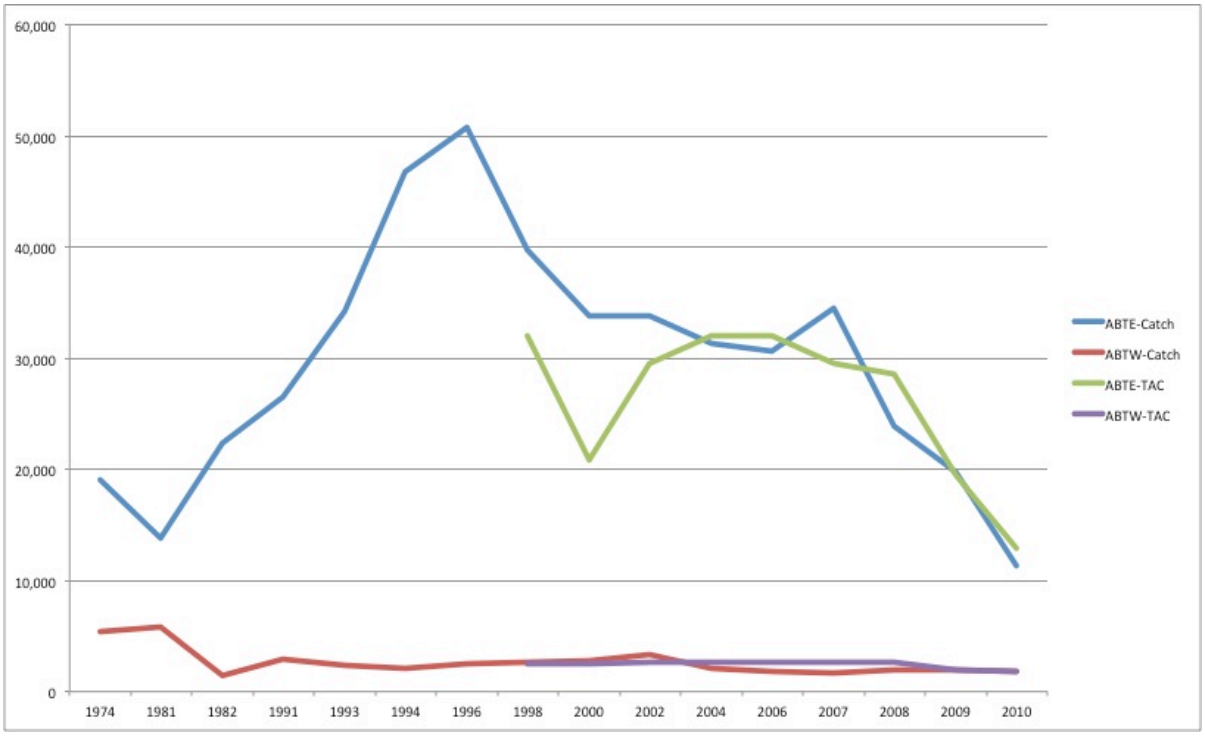

Figure 14. Comparison of TAC and catch for both ABTE and ABTW at the time of the major management dates.

Adapted from: Tag-A-Giant Foundation. (n/d). *International fishery management of Atlantic Bluefin Tuna*, p. 1; ICCAT. (2012, October 1-5). Report of the Standing Committee on Research and Statistics (SCRS PLE-104/2012). Catch data from BFT-Table 1, pp. 87-89. Madrid, Spain.

markets and therefore can be monetized, the resource should be managed in a way that it fetches a price as high as possible. (p. 35)

Figure 15 depicts the current policymaking approach for the Atlantic Bluefin Tuna.

In the case of the Atlantic Bluefin Tuna, the approach which has been advocated by ICCAT is questionable. ICCAT was formed in 1966 and by the time the organization began to function in 1969 no alternatives, other than what is called now the Western stock of the Atlantic Bluefin Tuna, were left to satisfy the Japanese markets for large bluefin tuna. By that time the Pacific Bluefin Tuna and the Southern Bluefin Tuna had already been heavily exploited. From this point forward, the resource was managed for maximum price utility, which drove the policy process. Martinez-Garmendia and Anderson (2005) wrote, "Bluefin tuna is considered the 'ultimate political fish' among the North Atlantic fishing nations and its most prominent final market destination, Japan" (p. 20). Currently, the species is being managed as a single species with two stocks, quota allocations, and using the controversial MSY measure. Figure 16 shows the result of ICCAT's policy approach to management of the Atlantic Bluefin Tuna.

ICCAT manages all of the species included in their charter through the single species approach. Periodically, the organization issues reports concerning the status of each of the species. The Atlantic Bluefin Tuna has not seen improvements in its stock size, and from all indications the biomass continues in a downward trend. There is a fundamental and philosophical difference between managing a single species and managing a species as a part of a greater system. Single species management does not take into account the changes caused by the disappearance of a higher or lower level predator or the environmental conditions. For example, nobody knows what the total effect the BP oil spill in the Gulf of Mexico will have on the Western stock spawns of 2010 or the spawning population. Botsford et al. (1997) wrote:

Current Atlantic Bluefin Tuna Policy Approach

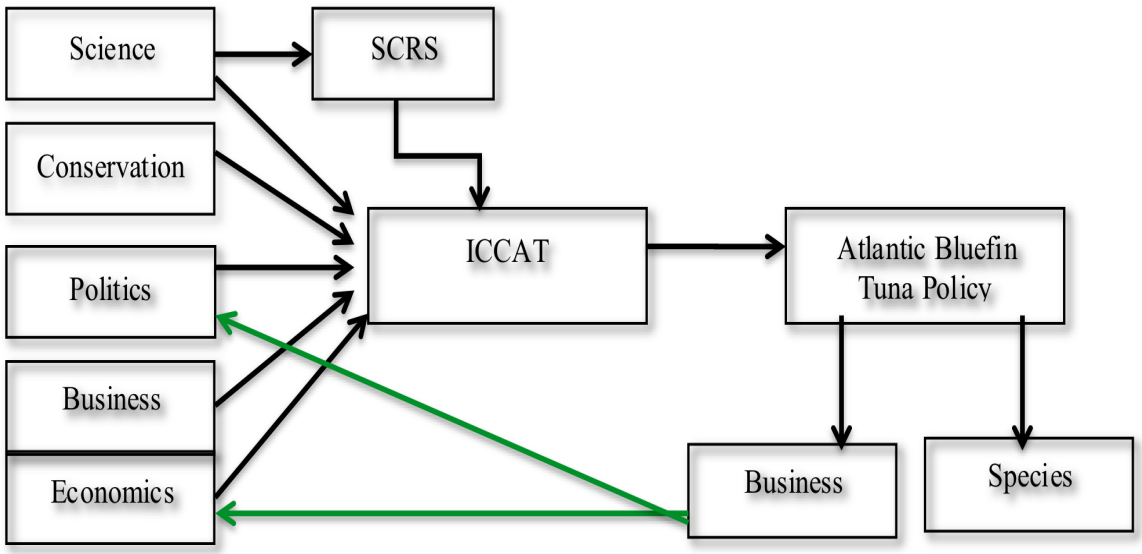

Figure 15. Current approach of public policies making for the Atlantic Bluefin Tuna.

ICCAT Policy Approach for the Atlantic Bluefin Tuna

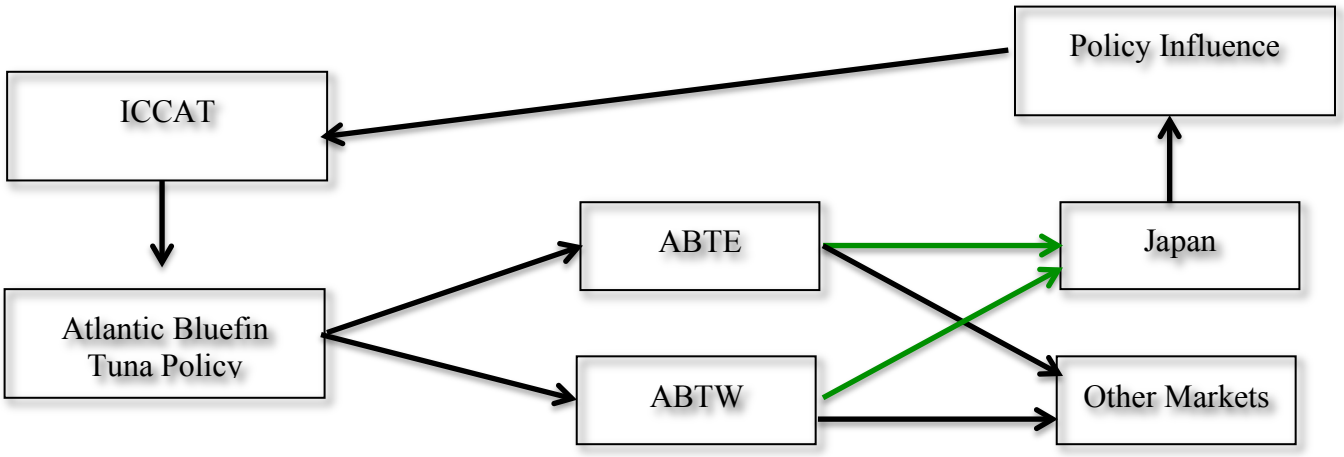

Figure 16. Current ICCAT policy approach for the Atlantic Bluefin Tuna.

> Because of the complexity of marine ecosystems and the difficulty in sampling them, fishery scientists have only rarely taken an ecosystem approach to management. It has been proposed that this lack of ecosystem approaches to fisheries management contributes to world overfishing and stock depletion. (p. 509)

In 1980, ICCAT decided the Atlantic Bluefin Tuna should be divided into two separate stocks, the Eastern stock, those fish that primarily live east of the 45-degree longitude and the Western stock, those fish living west of the 45-degree longitude. The map in Figure 17 shows the 45th parallel dividing line of management areas.

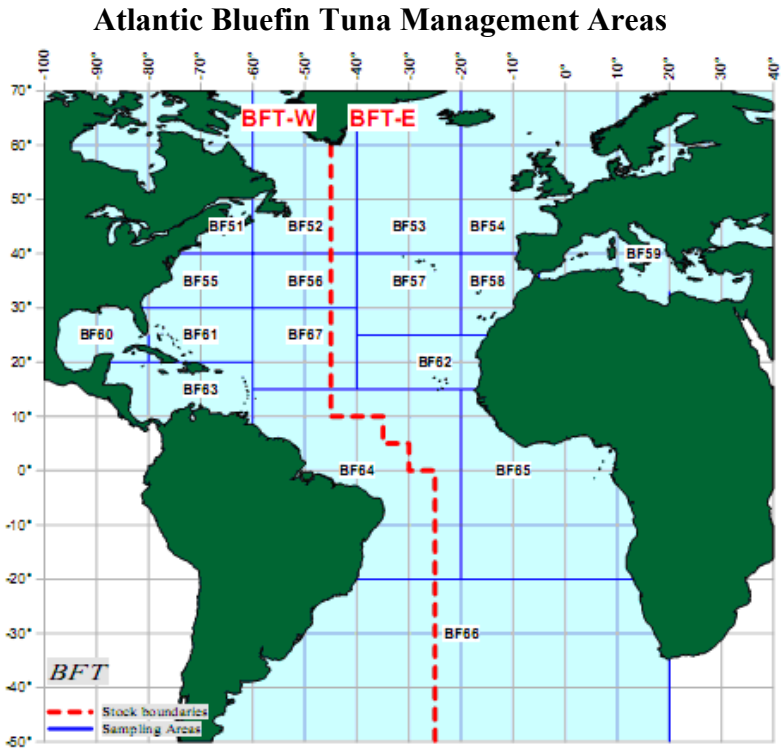

Figure 17. Management zones established by ICCAT to manage the Atlantic Bluefin Tuna.

Note. Eastern stock fish are designated ABTE and Western stock fish are designated ABTW.

Adapted from the International Commission for Conservation of Atlantic Bluefin Tuna. (2012, July). *ICCAT Statistical Bulletin, 41,* Madrid, Spain.

The division of stocks for management purposes has been controversial among scientists because the arbitrary line assumes there is little or no mixing of the stocks at the 45th parallel. The results of tagging data suggest there is much more mixing than thought (Tag-A-Giant Foundation, n/d). One of the complications of this line is that the Western stock fish, which migrate across the 45th parallel, are subject to harvest as Eastern stock fish, further depleting the already highly depleted Western stock. ICCAT has considered, and continues to consider, other management schemes, however, as of this date, none have been adopted.

The Atlantic Bluefin Tuna that comprise the Western stock are typically bigger, reach sexual maturity at a later age, and apparently live longer naturally than those of the Eastern stock. The larger size of these fish makes them more desirable for the Japanese market. ICCAT began restricting catch of the Western stock as early as 1974, however, imposed quotas were voluntary. In 1981, the fishery was closed due to small quantities, however the stock continued to decline. Webster (2011) wrote, "The sudden discovery that the western Bluefin tuna stock was severely depleted in 1981 suggests that previous assessments did not really reflect the seriousness of the situation" (p. 192). Webster further wrote, "High priced like the eastern stock, but with a much smaller biomass, western Bluefin has received more attention than any other stock in the commission's jurisdiction" (p. 173).

The Atlantic Bluefin Tuna that comprise the Eastern stock are smaller than those of the Western stock, however, the stock size is much greater. The current state of the stock is the result of a continued dismissal of scientific advice concerning catch levels. The Eastern stock is subject to a higher degree of IUU fishing because of the nature of the Mediterranean Sea (larger coastline per unit surface area being fished) and the multiple jurisdictions involved. Webster (2011) wrote, "The commission has consistently set legal catch levels that are higher than those recommended by the SCRS but quite close to the estimated total harvest" (p. 249).

According to the Gentner Consulting Group (2009, p. 3), preparers of the Domestic Economic Impacts of a CITES Appendix I Listing for Bluefin Tuna:

- Bluefin tuna stocks in both the Western and Eastern Atlantic are in trouble.
- Years of exceeding mortality quotas and lack of management action to blame.
- Current ICCAT quotas set 1.5 to 2.5 times higher than recommended by ICCAT scientists.
- Quota in Eastern Atlantic regularly exceeded by as much as 240%.
- Illegal fishing rampant in Eastern Atlantic.
- Management labeled an "international disgrace."
- Species in danger of extinction in the near future and qualifies for a CITES Appendix I listing.

Quota allocations, or TAC are issued to each country. In the past, these quotas have been based on existing harvest levels and not based on levels that are sustainable. Historically, ICCAT has based quotas on the controversial measure of MSY. A recent SCRS assessment found the spawning mass of the Western stock was around 41% of the level that would support MSY (Webster, 2011, p. 173). Ironically, the Blue Marlin and the White Marlin are the "only two other stocks that are managed by the commission [that] have been reduced to lower levels, and both of those are bycatch species" (Webster, 2011, p. 173).

Therefore, **H_3**—The current policy approach is failing and will eventually lead to a failed species—is upheld. According to Articles 30 and 36 of the World Summit on Sustainable Development on Implementation Plan, sound science and an ecosystem approach are fundamental underpinnings to sustainable fisheries. Unless public policies surrounding the Atlantic Bluefin Tuna are improved, the current policy approach will eventually lead to a failed species.

H_4. Current Management Policy of Atlantic Bluefin Tuna is Failing to Maintain a Sustainable Population

The Atlantic Bluefin Tuna has been the focus of more ICCAT regulations than any other species managed by the commission (Webster, 2011). Some have dismissed the lack of results to restore the stocks as a problem of common resource allocation: in short, a tragedy of the commons. However, the data show that more time has been spent discussing the status of the species and what measures should be taken to restore it to a healthy population than any other species. Figure 18 shows the number of resolutions and recommendations adopted by ICCAT from 1969 to 2006, including the 54 concerning the Atlantic Bluefin Tuna (almost twice as many as for any other species).

ICCAT Resolutions and Recommendations 1969-2006

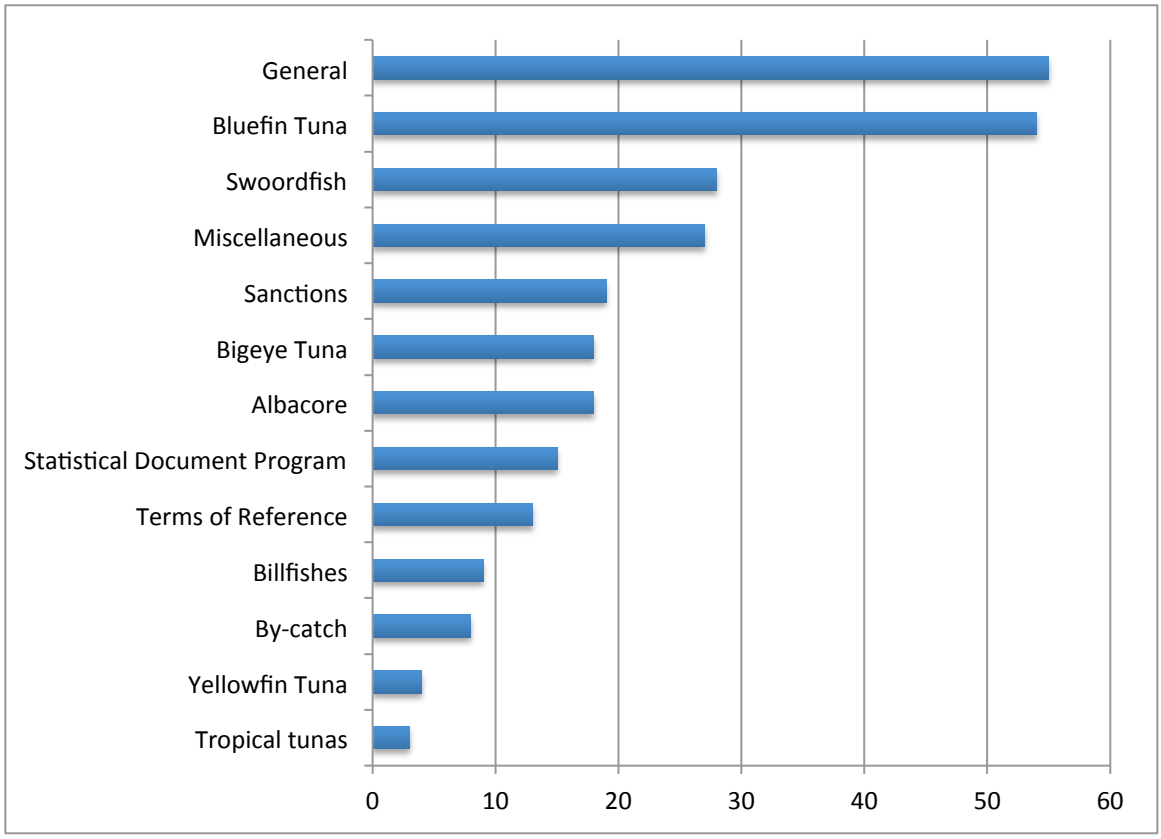

Figure 18. Comparison of the number of resolutions and recommendations adopted by ICCAT from 1969 to 2006. Adapted from "Adaptive Governance: The Dynamics of Atlantic Fisheries Management," by D.G. Webster, 2011, p. 170.

The Atlantic Bluefin Tuna is not as resilient to overfishing as some other marine species, including tropical tunas such as the Yellowfin Tuna (*Thunnus albacares*) and the Skipjack Tuna (*Katsuwonus pelamis*). These species have an early maturation, high fecundity, protracted spawning time, and wide spawning areas. The Atlantic Bluefin Tuna has late maturation, high fecundity, but spawns in closely defined areas and only for very short periods of time. Bluefin Tuna have the tendency to concentrate in well known spawning grounds and feeding areas, making them easy to spot and predictable. These factors are exacerbated by the desire for its flesh and popularity as a gamefish. Porch (2005) wrote, "The combination of extraordinarily high demand and relatively low resilience to fishing pressure makes for a volatile situation for managers" (p. 370). In order to sustain viable populations of species that are less tolerant of overfishing, more stringent management is necessary. However, ICCAT has appeared to be more concerned with discussions concerning administrative issues, such as setting a boundary to separate the stocks, rather than understanding the perils associated with stock collapse.

From the economic perspective, the Western stock has been an exceptional fishery because of the high prices paid for the fish that support numerous businesses. Since 1991, the Western stock has fluctuated around 50% of the amount that would support MSY or between 18% and 27% of the 1975 stock level (Webster, 2011, p. 251). Much uncertainty remains in how stock size is established. Webster wrote, "In fact, the total allowable catch plus national quota distribution system that is ICCAT's most common management tool evolved in the 1980s as a response to declining populations and harvests of western Bluefin" (p. 173).

The Eastern stock has been overexploited in the same manner as the Western stock. However, because the stock is larger and more prolific, it has apparently been able to sustain a higher harvest level. The SCRS estimated the spawning stock of the Eastern stock was 48% of the 1974-1975 levels in 2004 (Webster, 2011, p. 195). The SCRS further reported that the stock

condition was probably worse because of IUU fishing. Tuna ranching is widespread in the Mediterranean Sea and controversial because of the large quantities of fish removed from the spawning stock.

The Atlantic Bluefin Tuna has an inherent value to the world's marine ecosystem and to global fishing industries. In the ecosystem they are considered to be the "quintessential predator," with their diets consisting mainly of crustaceans, fish, and cephalopods during their juvenile years and as adults, fish such as herring, anchovy, sand-lance, sardine, sprat, bluefish, mackerel, jellyfish, salps, octopus, crabs, and sponges (Fromentin, 2010, 1353). According to the proposal to include Atlantic Bluefin Tuna on Appendix I of CITES (2010a), "The ecological extinction of this species would thus have unpredictable cascading effects in the North Atlantic, Mediterranean and Gulf of Mexico ecosystems and entail serious consequences to many other species in the food web" (CITES, 2010a). Webster (2011) wrote, "Geographic serendipity and a lack of substitutes for the extremely high-priced Bluefin are credited as the main causes of divergence from the vulnerability response predictions" (p. 171).

Therefore, **H_4**—Current management policy of Atlantic Bluefin Tuna is failing to maintain a sustainable population—is upheld.

H_5. International Policymakers are More Interested in Their Respective Constituencies' Welfare Than the Welfare of the Species

Resources are an important component to influencing policy; however, the availability of resources does not guarantee a desired policy outcome. Baumgartner et al. (2009) wrote, "Nonetheless, the relationship between money and political outcomes is far from simple, largely because where large amounts of money come into play on one side, others often mobilize, as well" (p. 193). The exceptional value of the Atlantic Bluefin Tuna flesh has caused the ICCAT negotiations to be very contentious through the years. The dialog has become more complicated

by the addition of tuna ranching in the Mediterranean Sea. Bonano and Constance (1996) wrote, "The inability of nation-states to legitimize accumulation strategies led to the globalization of tuna operations and the redistribution of power among relevant players" (p. 141).

In 1991, Sweden nominated the Western stock of the Atlantic Bluefin Tuna to be included in Appendix I of CITES. In 2009, Monaco nominated the Eastern stock for inclusion. Both measures failed largely because of the resistance encountered, led by Japan. The United States, France, Spain, and other countries also opposed the listing, believing that ICCAT was the appropriate entity to manage the species. ICCAT responded, in a preemptive measure to thwart other Appendix I listing attempts, to both failed efforts by restructuring quotas, improving reporting methods, and establishing enforcement tools.

The nomination to a CITES Appendix I listing had both positive and negative benefits for the Atlantic Bluefin Tuna. On the positive side, ICCAT set quotas for the Western stock at pre-1991 levels (Webster, 2011). Also, new mechanisms to track trade were developed and implemented in order to identify IUU catches. Positive results for the 2009 effort brought more publicity and nongovernmental organization efforts on behalf of the species. Porch (2005) wrote, "Perhaps one day soon this grass roots movement will combine with irrefutable scientific evidence to change the political will" (p. 381). On the negative side, noncompliance and successful management, in particular the Eastern stock, remains a problem.

Japan is the largest consumer of Atlantic Bluefin Tuna flesh in the world; therefore, it is the country that stands the most to lose through a reduction of harvest. The Japanese people are very dependent on the oceans' bounty as a source of protein. Further, there are sociological attachments to seafood, especially the Atlantic Bluefin Tuna. Japan has had a major influence in international fisheries policy; and in Japan there is an exceptionally close relationship between government and the fishing industry. Bergin and Howard (1996) wrote:

> The fishing industry itself retains important influence in the contemporary Japanese politics and society. . .The post-war expansion between the Japanese fishing industry was due to the close relationship between government and industry. The power and influence of the industry increased as Japan became the world's major fishing nation. (p. 75)

As the waters surrounding Japan became depleted of desirable fish stocks, the Japanese developed a state of the art distant waters fishing fleet, which essentially spans the world in search and in harvest of fish. As more nations have declared EEZs, the waters available to foreign vessels have declined. With the emergence of international fishing treaties and RFMOs, Japan decided to be a prime player in shaping policies. A prime influence in fisheries policy in the 21st century is conservation.

The Japanese perspective concerning conservation is viewed as attacks on their way of life. Some have claimed this view was forged out of resentment for the cultural imperialism of anti-whaling countries. Whale meat had been an essential form of protein to prevent starvation in post-war Japan. Public knowledge and interest in conservation historically has been minimal, while the commercial sector has been focused on conserving quotas that will allow greatest harvest. Bergin and Howard (1996) wrote:

> When it comes to conservation, the repeated emphasis on the role of science in ensuring conservation objectives are met can best be understood as a reaction by the Japanese to what are perceived as attacks on their fishing interests by environmentalists who are seen as concerned to 'over protect' marine resources. (p. 153)

Japan shows its influence and power at the RFMO meetings in numerous ways, including building alliances and gathering votes that favor their position. This is accomplished through joint ventures and assisting other countries to develop their own fishing fleets. And, "Fisheries aid comes in the form of goods and services and a small scale fisheries grant supplied in

connection with access agreements" (Bergin & Howard, 1996, p. 73). These tactics were learned during the anti-whaling campaign the Japanese viewed as the "tuna wars." For example, in 2002 two small countries, Cape Verde and Benin, became members of the IWC, a few days after the Japanese forecasted that the 17-year old moratorium on commercial whaling would be overturned. The prediction and the addition of the two countries were connected because the Japanese were providing millions of dollars in aid to these and other small and impoverished countries, "some of which have subsequently joined the IWC and supported the resumption of whaling. . .Conservation groups, and even some governments, have denounced it as a massive vote-buying scam" (Brown, 2002, para. 3).

Another example, in 2006 the IWC adopted the "St. Kitts Declaration," a pro-whaling action, two-thirds of the countries voting for passage of the declaration had received fisheries aid from Japan. Twenty-two countries, collectively, had received 56.4 billion yen (approximately $470 million) in the previous 2 years (Greenpeace International, 2009). Bergin and Howard (1996) wrote, "In the past the fishing industry was not particularly keen on joint ventures because they were seen as high risk. But there is now a recognition that Japan needs allies abroad to maintain its fishing interests" (p. 154). Figure 19 shows the flow through which Japan achieves its fisheries policies objectives.

Japan created the Overseas Fisheries Cooperation Foundation (OFCF) and it has become one of the largest nonprofit, public policymaking corporations in the world. The Foundation was established in 1973 because of a strong campaign launched by the Japan Fisheries Association (JPA). OFCF is semigovernmental in character and in the manner in which it operates; however, it is an industry-lobbying group that represents almost all segments of the Japanese fishing industry. Giant corporations and federations of small cooperative associations consisting of

Japanese Approach to International Fisheries Policymaking at the RFMO Level

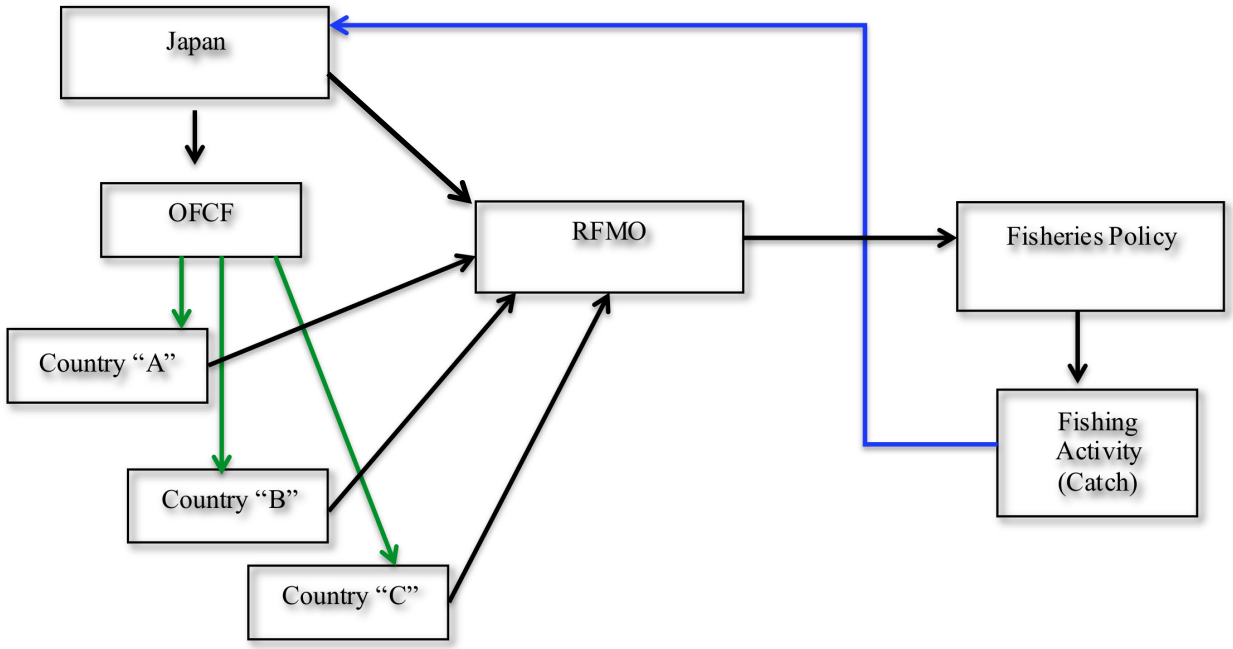

Figure 19. Japanese influence flow at the RFMO level to achieve maximum utility for fishery policies and fishing operations.

artisanal fishermen are included ("Japan Makes Major Change," 1978, p. 75-76). OFCF has five main purposes, as follows:

- To provide loans that are low interest, long-term funds to Japanese-owned or controlled fishing companies located overseas.
- To train Japanese fisheries experts for overseas aid assignments.
- To invite foreign fisheries trainees and leaders to visit Japan, or to be trained in Japan.
- To aid in bilateral fisheries negotiations, and
- To station Japanese fisheries experts in coastal nations for technical development aid. ("Japan Makes Major Change," 1978, pp. 75-76)

In the beginning, only Japanese nationals were entitled to receive the low-cost loans from OFCF. However, in October 1977, the decision was made to make loans available directly to other entities. That year, a consortium of five Japanese fishing companies placed, and were successful in winning, a bid to develop fisheries in the Patagonian region of Argentina. Part of the agreement included the transfer of ownership from Japan to Argentina of two specially constructed research vessels, built according to Argentinian specifications ("Japan Makes Major Change, 1978, pp. 75-76). Bergin and Howard (1996) wrote:

> In understanding Japan's multi-pronged process of adjustment for its distant water fisheries it is important to understand that both government and industry managers are essentially reactive…only short-term responses to what are seems as the most pressing political and economic problems. (p. 151)

The other major player in international fisheries policy is the United States. The United States Atlantic Bluefin Tuna industry has compiled to rather impressive statistics, as follows:

- 35,568 Atlantic tuna permit holders in 2008
- 4,338 of those permit holders were commercial fishermen

- 395 permitted dealers in 2008
- 250 permitted international dealers in 2008
- In 2008, 587,133 pounds with a value of $5.2 million were landed by commercial fishermen
- In 2008, the United States exported 323,277 pounds with a value of $3.3 million (Higher-quality/higher-value bluefin are typically exported)
- In 2008, the United States imported 801,200 pounds with a value of $12.2 million.
- In 2008, the United States re-exported 37,082 pounds with a value of $445,094
- Landings, exports, imports and re-exports have been falling over the past five years
- In 2008, the United States imported 23.9 percent more bluefin than it produced domestically, representing the lowest percentage imports in the past five years
- Total U.S. consumption is also down over the past five years
- The United States is a net importer of Bluefin. (Gentner Consulting Group, 209, p. 4)

From the economic perspective, the impact of Atlantic Bluefin Tuna trade has certain impacts on the economy. The total commercial fishing has an output of $97.9 million and employs 1,486 people (Gentner Consulting Group, 2009, p. 3). Landings, including the entire chain to consumer, have an output of $61.3 million and employ 945 people. The retail trade dominates the trade sector with 50.7% of all impact. Total output of exports is $7.2 million (p. 4). Recreational fishing is responsible for $41.6 million in output and 332 jobs (p. 5). In summary, the United States has a strong and vibrant Atlantic Bluefin Tuna industry that exerts influence on international fisheries policy.

ICCAT has implemented regulations in accordance with the SCRS advice for other stocks under its jurisdiction, namely the North Atlantic Swordfish (*Xiphias gladius*) and Bigeye Tuna (*Thunns obesus*) and have met with success. These measures were the same as those that

would be implemented for the Atlantic Bluefin Tuna. Webster (2011) wrote, "This variation is not just an interesting anomaly in an otherwise typical example of institutional failure: it is an excellent natural experiment that provides insight into the role of incentives in international resource management" (p. 251). As the tipping point arrives for the oceans of the world a new paradigm must be adopted. The species that live in the oceans are a natural resource, which can be harvested responsibly without upsetting the fragile balance of nature. The Atlantic Bluefin Tuna has and inherent value to the world's global fishing industries because of the number of individuals that benefit from the harvest of the fish. From the fisher to the end user, the fish supports many people. However, today it is the big corporations, such as Mitsubishi, that are stockpiling tons of Atlantic Bluefin Tuna in freezers that stand to receive the most benefit in the long run (Murray & Clover, 2009. DVD). Perhaps, Arnason et al. (2009) best summarized the benefit for all:

> The transition to economically healthy fisheries will require political will to implement reforms that incur political, social, and economic costs. These are the costs of rebuilding fish stocks, which requires an initial reduction in fishing activity and harvest rates…Once recovered, many ocean fisheries can generate substantial economic surplus and turn a net economic loss to society into a significant driver of economic growth and a basis for alternative livelihood opportunities. (p. xxi)

Therefore, **H_5**—International policymakers are more interested in their respective constituencies' welfare than the welfare of the species—is upheld because played out on the international level policymakers have a natural tendency to protect their own interests instead of making decisions based on the normative principle.

H_6. Current Public Policy is not Effective at Governing the Atlantic Bluefin Tuna Fisheries

The effectiveness of the current public policies governing the Atlantic Bluefin Tuna fisheries is in question because of the continued decline of the stocks. Today, the only international mechanism available to manage the species is ICCAT. Ellis (2008) wrote:

> In 1981, ICCAT declared the Atlantic Bluefin Tuna seriously depleted, and tried to set a quota as near zero as feasible. Within two years political pressure by the fishermen's lobby rejected this idea, and the quota for 1983 was 2,600 metric tons—a far cry from zero. (p. 121)

Webster (2011) wrote, "ICCAT is therefore the only international body that can protect bluefin tuna and, unless public outcry reaches the volume initiated by dolphins, elephants, or whales, the future of the species rests in their sometimes-capable hands" (p. 251). And, Renton (2008) wrote:

> ICCAT may be the most ineffective international organisation of all time. In the course of its 42-year life, several tuna species in the Mediterranean and Atlantic have come near disappearing, and nearly all are in grave danger. Despite the endless conferences and scientific studies sponsored by ICCAT and member nations, WWF's analysis shows that catches of Bluefin tuna, a 'critically endangered species', according to the standards of the respected World Conservation Union, are 'dramatically higher' than the quotas set. And that catches are consistently under-reported, or not reported at all. (p. 28)

Effective management of the large, long-living, and late maturing pelagic species has been difficult, in part, because of how the decisions of the international fishery management organizations are made. The fisheries management organization, ICCAT, charged with managing the Atlantic Bluefin Tuna has the tools at hand to properly manage the species; however, ICCAT lacks the policy mandate and the policing power necessary for success. Policy

mandates come from political will and some of the signatories have not exerted their responsibility to the commons, yielding their authority to outside interested influences.

The continued decline of the Atlantic Bluefin Tuna is a public policy problem because it is an issue that transcends all of the barriers that public policy is designed to manage—commerce, environmentalism, economics, foreign trade, and behavior. The very precepts of public policy were created to provide structure and rules of the game, a leveling of the playing field in issues that involved all peoples. ICCAT is an international consortium sanctioned by the United Nations where decisions are made by consensus. If a consensus cannot be reached concerning an issue, then no action is taken. Even attempts at listing the species through the CITES have failed. Thomas Jefferson (1801) in his first inaugural address said:

> Bear in mind this sacred principle, that though the will of the majority is in all cases to prevail, that will to be rightful, must be reasonable; that the minority possess their equal rights, which equal laws must protect, and to violate would be oppression.

Consensus voting supposedly provides for the protection of the minority; however, as Jefferson stated, it must be reasonable. Reasonableness has not entered ICCAT's decision making, because decisions based on reasonableness would give more weight to scientific measurement and possible collapse rather than the influences of business and those interested in taking the last fish.

Therefore, **H_6**—Current public policy is not effective at governing the Atlantic Bluefin Tuna fisheries—is upheld. The mechanism of today's public policies is not effective at governing the Atlantic Bluefin fisheries.

In summary:

H_1. The future state of the Atlantic Bluefin Tuna species is in danger of collapse, is upheld based on the analysis of NMFS, NOAA, and ICCAT. Unless dramatic reductions in

catch are established and enforced, the Atlantic Bluefin Tuna as a species is in danger of collapse.

H_2. There is a relationship between policy and fishing activity, is upheld. However, current policy can only regulate legal fishing activities until punitive policies for IUU activities are put into place.

H_3. The current policy approach is failing and will eventually lead to a failed species, is upheld. According to Articles 30 and 36 of the World Summit on Sustainable Development on Implementation Plan, sound science and an ecosystem approach are fundamental underpinnings to sustainable fisheries. Unless public policies surrounding the Atlantic Bluefin Tuna are improved, the current policy approach will eventually lead to a failed species.

H_4. Current management policy of Atlantic Bluefin Tuna is failing to maintain a sustainable population, is upheld. In order to reverse the trend, a fundamental management policy change must take place.

H_5. International policy makers are more interested in their respective constituencies' welfare than the welfare of the species, is upheld because played out on the international level policymakers have a natural tendency to protect their own interests instead of making decisions based on the normative principle.

H_6. Current public policy is not effective at governing the Atlantic Bluefin Tuna fisheries, is upheld. Today's public policies are not effective at governing the Atlantic Bluefin fisheries.

Fischer's Analysis Framework

To analyze the public policies surrounding the Atlantic Bluefin Tuna, it was necessary to use a policy analysis framework. The policies surrounding the species were evaluated using the framework designed by Fischer (1995). The framework "must always look in two directions, one micro, the other macro" to evaluate a public policy. It is divided into two primary levels,

"First Order Evaluation" and "Second Order Evaluation." In First-order evaluation, the focus is "on the specific action setting of a policy initiative, probing both specific program outcomes and situational (or circumstantial) context in which they occur" (Fischer, 1995, p. 18). Second-order evaluation is "vindication and social choice." In this phase, the evaluation shifts to the larger social system of which the action context is a part; it focuses on the instrumental impact of the larger policy goals on the societal system as a whole and evaluation of the normative principles and values underlying this societal order (p. 19). Each level is further divided into two discourses. In the First-order Evaluation, there is a *Technical-Analytical Discourse* that is quantitative and a *Contextual Discourse* that is qualitative. The goal is to place a quantitative assessment of the policy to determine its efficiency. In the Second Order Evaluation, there is a *Systems Discourse* that provides societal vindication and an *Ideological Discourse* that provides for social choice.

First Order Evaluation of Atlantic Bluefin Tuna Public Policy

In First-order evaluation, the focus is "on the specific action setting of a policy initiative, probing both specific program outcomes and situational (or circumstantial) context in which they occur" (Fischer, 1995, p. 18). The policy initiative was first defined by the FAO:

> The Conference of the Food and Agriculture Organization of the United Nations, at its Thirteenth Session held in Rome in November and December 1965, authorized the Director-General of that Organization to call a Conference of Plenipotentiaries to prepare and adopt a Convention for the purpose of establishing a Commission for the conservation of tuna and tuna-like fishes in the Atlantic Ocean. (ICCAT, 2007, p. 3).

In the *Basic Texts* document, ICCAT (2007) sets out the Preamble of the organization as:

> The Governments whose duly authorized representatives have subscribed hereto, considering their mutual interest in the populations of tuna and tuna-like fishes found in

> the Atlantic Ocean, and desiring to co-operate in maintaining the populations of these fishes at levels which will permit the maximum sustainable catch for food and other purposes, resolve to conclude a Convention for the conservation of the resources of tuna and tuna-like fishes of the Atlantic Ocean. . . .(p. 5)

Therefore, the organization is organized as a "commission for the conservation of tuna and tuna-like fishes in the Atlantic Ocean" (p. 3); however, the purpose of the conservation is to maintain "the populations of these fishes at levels which will permit the maximum sustainable catch for food and other purposes" (p. 5). Thus, the organization is primarily designed to justify continued harvest of the "tuna and tuna-like fishes in the Atlantic Ocean" (p. 5). Article VIII of the *Basic Texts* states, "The Commission may, on the basis of scientific evidence, make recommendations designed to maintain the populations of tuna and tuna-like fishes that may be taken in the Convention area at levels which will permit the maximum sustainable catch" (p. 7). Again, the intent appears to be "maximum sustainable catch" (p. 7).

ICCAT's policies on all species, including the Atlantic Bluefin Tuna, can be divided into three different and distinct stages. The first stage encompasses the years between 1969 and 1974. During this time, the organization primarily served as a research and recommendation body. The contracting parties generally ignored the recommendations ICCAT made respective of the Atlantic Bluefin Tuna. The second stage encompasses the years between 1974 and 1996. ICCAT made an increased effort to organize and manage the Atlantic Bluefin Tuna fishery. However, it was largely ineffective for numerous reasons, including lack of jurisdiction and lack of punitive measures. The third stage began in 1996 when a general strengthening of ICCAT policies were implemented.

In order to understand the current status of the Atlantic Bluefin tuna fishery, it is essential to understand the manner in which ICCAT operated, and in large part operates today. From the

beginning, ICCAT was largely expected to coordinate "a mutual interest in maintaining the populations of tuna and tuna-like fishes found in the Atlantic Ocean" (ICCAT, 2007, p. 5). In 1966, very little research on the biology, stock levels, or habits had been completed on the Atlantic Bluefin Tuna. ICCAT began to coordinate and compile scientific research and issue recommendations, however, these were often ambiguous and difficult to implement.

In 1996, ICCAT introduced import bans of tuna flesh from countries found to violate its conservation rules—in essence, those that were not signatory members of the commission. Until this time, there was little incentive for some nations to join the ICCAT (De Fontaubert & Lutchman, 2003, p. 58). This action removed any incentives for disregarding ICCAT policies. However, this was an action to prevent trade from a nonsignatory country. In 1996, following the import ban implementation, ICCAT instituted harsher punishments for members exceeding their quotas, beginning in 1997. Recommendation 96-14 states:

> Any contracting party exceeds its catch limit, its catch limit will be reduced in the next subsequent management period by 100% and the ICCAT may authorize other appropriate actions. . .if any contracting party exceeds it's catch limit during any two consecutive management periods, the commission will recommend appropriate measures, which may include, but are not limited to reduction in catch limit equal to 125% of the excess harvest, and, if necessary, trade restrictive measures. Any trade measures under this paragraph will be import restrictions on the subject species and consistent with each Party's international obligations. The trade measures will be of such duration and under such conditions as the Commission may determine. (ICCAT, 2008)

In summary, the policy has been largely an economic-driven policy in the interest of maintaining "the populations of tuna and tuna-like fishes found in the Atlantic Ocean. . .at levels which will permit the maximum sustainable catch for food and other purposes" (ICCAT, 2007, p. 7). Anderson (1990) wrote, "Under present regulations, it appears impossible for the bluefin stocks to increase. Instead, we may see a collapse of the spawning population, which would lead to severe reduction in recruitment fish for as long as a decade or more" (p. 33). Therefore, the

organization's purpose and operations form a collision between commerce and conservation, rather than a partnership.

Technical-analytical discourse - First order evaluation of Atlantic bluefin tuna public policy. The goal of the Technical-Analytical Discourse is to place a quantitative assessment of the policy to determine its efficiency. Fischer (1995) wrote, "Verification is the most familiar of the four discursive phases" (p. 30). In fisheries policy, this quantitative component of evaluation can take on many forms from Cost Benefit Analysis of the commercial take to the catch limits that are established by a regulating agency, or RFMO. Increasingly, the Atlantic Bluefin Tuna catch limit numbers, or TAC, are not being reached, leading to the conclusion that the catch limits are set beyond the fisheries' capacity to regenerate or exist at levels that are sustainable. Not only is the quantity of fish declining, the size of those that are caught are increasingly smaller. The conclusion is that fish are not reaching the age of sexual maturity in order to reproduce.

To place a quantitative assessment of the current policy to determine its efficiency, as stated as the organization's purpose, "maintaining the populations of these fishes at levels which will permit the maximum sustainable catch for food and other purposes. . . ." (ICCAT, 2007) is a challenging proposition because quotas have been set, in part, based on catch levels instead of science. This strategy may have worked in the short run; however, as stocks are further depleted the realization of smaller stocks will prevail, eventually making the policy totally unworkable.

Contextual discourse - First order evaluation of Atlantic bluefin tuna public policy. The goal of the *Situational Validation* is to place a qualitative assessment of the policy to determine its relevancy. Fischer (1995) wrote, "Validation focuses on whether or not the particular program objectives are relevant to the situation" (p. 20). The program objectives, to date, have been relevant to the situation in that it sought to maintain, populations of these fishes

at levels which will permit the maximum sustainable catch. The Atlantic Bluefin Tuna is a self-renewing resource and if harvested at reasonable rates, abundance would be the norm. However, the entire precept that has guided ICCAT has been harvest that exceeds what is available.

In the case of the Atlantic Bluefin Tuna the objectives are relevant to the situation, however, relevancy is dependent on intent of the policy. If the policy is to maintain a sustainable population, ICCAT has failed miserably for almost six decades. If the policy is to harvest all possible, ICCAT has been successful.

Second Order Evaluation of Atlantic Bluefin Tuna Public Policy

Second Order Evaluation provides for vindication and social choice. Here evaluation shifts to the larger social system of which the action context is a part; it focuses on the instrumental impact of the larger policy goals on the societal system as a whole and evaluation of the normative principles and values underlying this societal order (Fischer, 1995, p. 19). In the Second Order Evaluation there is a *Systems Discourse*. Fischer wrote, "The basic task is to show that a policy goal [from which specific objectives were drawn] addresses a valuable function for the societal arrangements" (p. 21).

Systems discourse - Second order evaluation of Atlantic bluefin tuna public policy. The goal of the Systems Discourse is to provide societal vindication. Fischer (1995) wrote, "The basic task is to show that a policy goal (from which specific objectives were drawn) addresses a valuable function for the societal arrangements" (p. 21). In fisheries policy this would evaluate how a policy was making progress in restoring a fishery and how it would contribute to all citizens of the world, in other words, healthy fisheries would benefit society.

Perhaps no other species has been more abused and mismanaged by the greater world community than the Atlantic Bluefin Tuna. Effective regulation of the Atlantic Bluefin Tuna has been hampered by various positions taken by the multitude of special interest groups, numerous

countries, and commercial interests, ultimately resulting in public policy that has little unity or coherence. Catastrophic depletions of the fisheries may adversely affect all peoples in a variety of manners from the loss of a source of nutrition to the loss of jobs. Further, declines in abundance and structural change to marine ecosystems may well affect the world in ways not yet fully understood. Both the persistent pattern of making fisheries policies, and the policies themselves, are troubling. Science has identified the problems, yet these factors have consistently been ignored as policies have been made in an attempt to solve the problem or stop the continued decline. The burden of establishing the policies to reverse the decline rests with the policymakers at multiple levels in many countries.

Ideological discourse - Second order evaluation of Atlantic bluefin tuna public policy. The goal of the Ideological Discourse is to provide for social choice. Fischer (1995) wrote that it seeks, "to establish and examine the selection of a critical basis for making rationally informed choices about societal systems and their respective ways of life" (p. 22). In fisheries policy, this would evaluate how life of each civilization would benefit from a more holistic approach to life through the choices they would make in consumption habits.

Ultimately, today's fisheries policies have been driven by what is available now, rather than what will be available tomorrow. This is an important philosophical concern because the world continues to add people that will be dependent on the world's oceans to ensure a healthy and plentiful tomorrow. A healthy and sustainable Atlantic Bluefin Tuna population is a part of the puzzle. Kurlansky (2008) wrote:

> Next to that calamitous scenario [destruction of ocean life], the survival of the few remaining picturesque fishing towns may seem like a small thing. But intertwined with the issue of biodiversity is the idea of sociodiversity—social diversity. Each culture each way of life that vanishes diminishes the richness of civilization and makes it more

> difficult for civilization to prosper. The multiplicity of cultures, like the multiplicity of biological species, is the guarantor of the continuation of life. (p. 245)

This policy evaluation model is particularly valuable for evaluating fisheries policy because

> The goal is not to 'plug in' answers to specific questions or fulfill pre-specified methodological requirements. It is to engage in an open and flexible exploration of the kinds of concerns raised in the various discursive phases of the probe. (Fischer, 1995, p. 19)

However, it is also important to include empirical evidence that works and to understand the who, how, and what are the channels of influence in the making of public policy. In the end, when the will to negotiate is absent, the commons are the losers. Perhaps the Mexican poet Octavio Paz said it best, "Every view of the world that becomes extinct, every culture that disappears, diminishes the possibility of life" (cited in Kurlansky, 2008, p. 245).

Certainly all countries of the world have experienced failure and challenges to survival. Japan finds itself in juxtaposition with the United States and Canada concerning fisheries policy. Canada learned first hand the perils of a collapsed fishery (the Nova Scotia cod), which after more than 30 years has not returned and caused an economic calamity that continues to this day. The United States has an enduring legacy of environmental failures for which more than token measures have been taken to reverse. Both the United States and Canada have learned the hard lessons and have taken major steps towards sustainability and restoral. Japan should heed the call and help restore the Atlantic Bluefin Tuna.

Fisheries policies should address the persistent problem of declining fish populations due to overfishing. President George W. Bush convened the U.S. Commission on Ocean Policy. The commission composed of members representing the fishing industry and academics;

however, it did not include environmentalists, fishermen, or anglers. Despite the inequality in representation, the commissioners concluded in their final report that there were serious problems with the sustainability of the ocean fisheries and that major changes are urgently needed in the manner they are managed.

CHAPTER 5. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

"World-wide practice of Conservation and the fair and continued access by all nations to the resources they need are the two indispensable foundations of continuous plenty and of permanent peace" (p. 506).

--Gifford Pinchot, 1947, noted U.S. politician and conservationist

Saving the Atlantic Bluefin Tuna Through Public Policy

For thousands of years the oceans of the world have been, and will continue to be, the source of all life on planet Earth. Humans have vigorously harvested the ocean's bounty, a naturally renewing resource, to the point of irreparable damage. In some areas of the world the oceans have reached the state in which they are virtually devoid of life. In parts of the world, the species that inhabit the oceans have been overharvested beyond their capability to regenerate and are reaching the tipping point that could eventually lead to collapse and beyond.

The peoples of the world should be aware and concerned about the state of the world's fisheries because of their importance as one of the prime sources of protein for humankind and the importance to the health of the entire world ecosystem. Catastrophic depletions of the fisheries will adversely affect all peoples in a variety of manners that will include the loss of an essential source of nutrition, livelihoods, and health. Further, declines in abundance and structural changes to marine ecosystems may well affect the world in ways not yet fully realized, identified, predicted, or understood.

Since the world's fisheries are managed through public policy, people should also be concerned about global fisheries policies, how they are formulated and implemented, and hold their respective government officials accountable for their decisions. Yet, despite the possible

consequences, some international policymakers seem to have been paralyzed and have not been capable of making the difficult choices that will ensure a positive and abundant tomorrow. Renton (2008) wrote,

> Once stocks dip below a certain critical level, the scientists believe, they can never recover because the entire eco-system has changed. The question is whether, after 50 years of vacillation and denial, there's any prospect of the politicians acting decisively now. (p. 28)

Earle (2009) wrote, "Our future is in jeopardy, while we fiddle with this and that, not willing to embrace the evidence" (p. 166).

Today, the one certainty that remains is, in spite of all of the rhetoric and discussion, the world's fisheries continue to decline at a precipitously alarming rate. Unless the world community unites to establish policies to benefit all peoples, the fisheries on which humans depend will collapse by 2048 (McKinney, Schoch, & Yonavjak, 2013, p. 182). The possibility still exists to repair or reverse the decline of some of the fisheries and ensure a world of plenty in the future. However, trying to predict the future by looking at the past combined with the short-term vision of immediate economic gain and clouded judgment must be supplanted by the vision and reality of long-term sustainability. The nations of the world will have to unite to define fisheries management in the future, including the common areas of the world, known as the high seas. For this type of radical approach, a leader in this quest must emerge because "played out at the world level, distorted perceptions of fairness and wishful thinking will only be worse…" (Baron, 1998, p. 42).

The peoples of the world should be concerned about the status of the Atlantic Bluefin Tuna because it is one of the iconic species of the ocean, an apex predator that helps maintain the

ecosystem in balance and functioning properly. Issenberg (2007) wrote, "It is perhaps the purest hunter-gatherer undertaking left on the earth, where luck remains tethered to the orbit of the moon and the movement of the Gulf Stream" (p. 166). Further, the species is an important source of nutrition, a cultural icon to many peoples, and an important economic driver in many countries. The solution to saving the Atlantic Bluefin Tuna does not lay in a complete and permanent ban of harvest rather it lay in responsible behavior combined with the practice of sustainable harvest methods and effectively made and enforced public policies.

This dissertation set out to examine the public policies surrounding the Atlantic Bluefin Tuna, how they are formulated, implemented, and enforced by the international bodies that have a stake in the species. Fisheries policies, and Atlantic Bluefin Tuna policies in particular, were examined through the lens of economics, conservation, science, business, and politics. The gathered information was then analyzed and interpreted within an established and accepted analysis framework. Finally, this analysis led to a proposed policy to save the species from collapse. The data revealed that the primary problem surrounding the decline of the worldwide fisheries, including the Atlantic Bluefin Tuna, is overfishing, the removal of biomass from the ecosystem at a rate that is not sustainable. Concerning fisheries as a whole, Scheffer, Carpenter, and de Young (2005) wrote:

> Profound indirect ecosystem effects of overfishing have been shown for coastal systems such as coral reefs and kelp forests. A new study from the ecosystem off the Canadian east coast now reveals that the elimination of large predatory fish can also cause marked cascading effects on the pelagic food web. Overall, the view emerges that, in a range of marine ecosystems, the effects of fisheries extend well beyond the collapse of fish exploited stocks. (p. 579)

Concerning the Atlantic Bluefin Tuna, Meski (cited in Safina & Klinger, 2008, p. 243) stated:

> The Atlantic bluefin tuna's western breeding population is unprecedentedly low and declining. Commercial catches off the United States have fallen to 10% of the quota, which suggests a population collapse. Recent research findings are not being incorporated into management decisions. Although the bluefin is a special fish, its problems are just one instructive example of how management can go off track if the scientific part of the process is corrupted by short-term economics and political lobbying.

Ellis (2008) wrote, "Hundreds of thousands of tons of Bluefin Tuna—which translates to billions of fish are caught every year. . . ." (p. 121).

Economic viability of any fishery should have a long-term horizon, where the fisheries are harvested in a sustainable manner because they are a natural resource that has the ability to renew itself. Ocean life does not adhere to management or national boundaries and as a result, long-term sustainability will require international cooperation. The economic impact of a healthy fishery compared to a collapsing fishery can be dramatic. When a particular fishery collapses, the repercussions go far beyond the scarcity of a fish. From the economic perspective, perhaps the most dramatic fisheries collapse lay in the economic implications of the lost cod industry in Nova Scotia, Canada, once known as the "world's greatest." In 1992, the Canadian government closed the cod fishery after 500 years of economic impact to many nations, companies, and individuals. Today, 20 years later, there is not any evidence that the fish are returning (Renton, 2008). The economy of Nova Scotia was totally dependent on the cod fishing industry and suddenly thousands of people found themselves out of work overnight, affecting every business from fuel providers to mortgage holders.

Closing the cod fishery included the closing of sections of the Georges Bank, historically one of the world's most productive fishing grounds. This action by the Canadian government also affected Gloucester, Massachusetts in a profound manner. Gloucester's importance as a fishing port was best described by Kurlansky (2008), "To the world of Atlantic fishing Gloucester, Massachusetts is an iconic place" (p. xiv). Its history dates to the 1600s and was a society completely based on fishing (p. 33). The Gloucester fishers primarily sought groundfish—cod, haddock (*Melanogrammus aeglefinus*), whiting (*Merlangius merlangus*), pollack (*Pollachius*), and halibut (*Hippoglossus hippoglossus*) —and later sought open-water predators like bluefish (*Pomatomus saltatrix*), herring (*Clupea harengus*), and mackerel (*Scomber scombrus*) (p. 125). As have other fishing communities, the fishers of Gloucester consistently sought to improve efficiency, maximizing output (catch) by minimizing input (fishing activity). This increased efficiency took the form of larger nets, better materials, and newer methods—long lining and trawling. While this improved their catch rates, very little consideration was given to the effects it was having on the fisheries. As the catch rates declined, the Gloucester fishers chose to travel further to sea in search of other species of fish to support their economy.

Paradoxically, the people of Gloucester understood the concept of finite resources and conservation. Kurlansky (2008) wrote:

> They treated trees that way, recognizing Cape Ann could produce barely enough lumber to build the Gloucester fishing fleet. They would have found it unthinkable to have given up their island's self-sufficiency by bringing in lumber from elsewhere. . .they placed restrictions on the private use of trees. . .regulated prices. . .restricted out of town sales. . . But, from the beginning they saw fish as limitless. (p. 470)

Supporting industries developed around the fishing fleet and fishers, from clothing manufacturers to tackle and supply providers. Today, Gloucester is best known as the port in the movie, *The Perfect Storm*; its tourist business, The Fishermen's Memorial and the Fishermen's Wives' Memorial, and nostalgically as the seaport that once was. Today, this economic scenario could be repeated many times over with the result being another failed fishing community and another failed economy caused by a collapsed fishery.

Humans have a reputation for waiting too long, or not taking action at all, to reverse the trend of decline of a natural resource. For example, the history of environmental policy, including resource management and conservation, in the United States is largely reactionary and crisis driven. Kuhn (1996) wrote, "Normal science ultimately leads only to the recognition of anomalies and to crises" (p. 122). Perhaps, this results from a lack of understanding of science, disbelief in the sciences, or because of the impreciseness of science. Science is the search for the truth and understanding; however, seldom is any result deemed a scientific certainty because in all scientific research a certain margin of error exists. Kuhn (1996) also wrote, "Normal science does and must continually strive to bring theory and fact into closer agreement, and that activity can easily be seen as testing or as a search for confirmation or falsification" (p. 80). For example, the world has been discussing the hole in the ozone for a number of years. Some measures have been implemented to retard the consequences; however, all the science that is available does not appear to be sufficient to create widespread comprehensive strategy, which will repair the damage already realized. Therefore, it is an essential challenge to ensure that science is correct, understandable, and credible**.** Earle (2009) wrote, "The good news is that with better understanding of the system coupled with care, recovery can follow" (p. 80).

Concerning the Atlantic Bluefin Tuna, all of the scientific research points towards a fishery that is in decline. The science reveals the stocks are declining because biomass is being removed from the ecosystem at a rate that is not sustainable. As more fish are removed from the breeding stock, females reach maturity at a smaller size and age, resulting in fewer eggs produced. Uncertainties in the science include developing an accurate census, simply because of the difficulty of counting highly migratory fish that travel the oceans. Empirical knowledge allows that there are less, and smaller, Atlantic Bluefin Tuna in the ocean. This has been recognized by ICCAT, however, management to date has been largely ineffective. Ellis (2008) wrote:

> In 1981, ICCAT declared the Atlantic Bluefin Tuna seriously depleted, and tried to set a quota as near zero as feasible. Within two years political pressure by the fishermen's lobby rejected this idea, and the quota for 1983 was 2,600 metric tons—a far cry from zero. (p. 121)

Kuhn (1996) wrote:

> If there were but one set of scientific problems, one world within which to work on them, and one set of standards for their solution, paradigm competition might be settled more or less routinely by some process like counting the number of problems solved by each. But in fact, these conditions are never met completely. The proponents of competing paradigms are always at least slightly at cross-purposes. Neither side will grant all of the non-empirical assumptions that the other needs in order to make its case. (p. 148)

Too often the term conservation has been co-opted to have a meaning that is connected to a particular political ideology. Conservation is a value that transcends political ideology and is the basis for responsibility. A true understanding of conservation involves knowledge of *what* is

being conserved and *why*. Conservation benefits all parties. Gifford Pinchot (1947), considered to be the father of the conservation movement in the United States wrote:

> The earth and its resources belong right to the people. Without natural resources life itself is impossible. From birth to death, natural resources, transformed for human use, feed, clothe, shelter, and transport us. Upon him or her we depend for every material necessity, comfort, convenience, and protection in our lives. Without abundant resources prosperity is out of reach. (p. 505)

Thus, conservation should be the wise use of the Earth's bounty for the good of all humans.

For decades some conservation efforts have been seen as obstacles to progress and growth instead of efforts to preserve a resource. Being conservation minded or a responsible steward of a natural resource does not mean progress, commerce, or growth must be crippled. Pinchot (1947) believed "conservation is the foresighted utilization, preservation, and/or renewal of forests, waters, lands, and minerals, for the greatest good of the greatest number for the longest time" (p. 506). Further, Pinchot believed

> that conservation policy should have three great purposes: First: wisely use, protect, preserve, and renew the natural resources of the Earth; second: to control the use of the natural resources and their products in the common interest, and to secure their distribution to the people at fair and reasonable charges for goods and services; and third: to see to it that the rights of the people to govern themselves should not be controlled by great monopolies through their power over natural resources. (p. 506)

Concerning the Atlantic Bluefin Tuna, conservation efforts have been difficult to implement and almost impossible to enforce because the demand for its flesh is so great. ICCAT was formed in the 1960s because the issue of species decline rose on the international agenda.

Safina (2003) wrote:

> By 1990 the bluefin breeding population stood at an all-time low. Conservation groups got involved in 1991, pursuing an international ban on bluefin trade through the Convention on International Trade in Endangered Species. In 1992 the tuna commission agreed to halve its West Atlantic bluefin quota, but gave itself two years to phase the cut in. . .And ICAAT – led by a US commissioner who is a fishing-industry-paid lobbyist – used the 'stabilisation' finding to justify rescinding the 50 per cent quota cut. After that, the commission increased the quota again to approximately where it had been from 1983-1992, when the breeding population had been roughly twice as large (but in continual decline). The spawning population now is about 10 per cent of what it was just prior to the Atlantic tuna commission's formation in the mid-1960s. (p. 47)

Business encompasses all revenue-generating entities in all sectors of the global economy. Businesses are the primary drivers of revenues and economic growth in the world. Businesses range from large multilateral corporations to one-person entities. Business is a necessity to the world; however, businesses are often portrayed as a growing evil, full of nefarious motives. This perception stems from those companies that use their financial resources to influence public policy in their favor.

Concerning the Atlantic Bluefin Tuna, businesses at all levels have emerged to satisfy a demand. If there is a demand for a product, there is surely a market and Bluefin tuna is no exception. With the emergence of air transportation and instant freezing technologies, fresh tuna from distant waters became readily available worldwide. Beginning in the late 1970s, Atlantic Bluefin Tuna caught off the United States began to be exported to Japan. Large corporations, like Mitsubishi, seeking to their bolster profits, soon noticed what began with a few individuals.

Further, the profit motive has driven illegal and unreported catches of Atlantic Bluefin Tuna. Issenberg (2007) wrote:

> People have probably fished outside of the law for as long as governments have required anglers to declare their catch for tax purposes, but rapacious fishermen and cunning launderers have made the new black-market seafood commerce—illegal, unregulated,

and unreported catches, or the trafficking of that product—into big business. These pirates may operate at the margins of the law, but they are not so much living outside the new global economy as thriving upon it. (p. 228)

In the end, one of the main influencers of public policy is plain old politics. Political pressure, it seems, will always drive political action. The financial stakes for all of those involved in selling the flesh of the Atlantic Bluefin Tuna to certain markets is high. Mitchell (2009) wrote, "Thus, compliance with fishing treaties often reflects the fact that economic and political conflicts lead to agreement on catch limits at or above the levels that the parties could reasonably catch" (p. 158)

Japan has been very influential internationally surrounding regulation of the Atlantic Bluefin Tuna, even leading the way to block an Appendix I CITES listing. In March 2010, the Principality of Monaco proposed an Appendix I listing at the CITES convention in Doha, Qatar. Using backroom horse-trading skills honed by years of negotiations and maneuvering at the IWC, the battle-hardened officials of Japan's Fisheries Agency were able to push through their agenda at the Convention on Trade in Endangered Species of Wild Fauna and Flora (CITES) in Doha, leaving their less experienced European and American counterparts in their wake. At the meeting, 72 out of 129 CITES members voted against listing the Atlantic Bluefin Tuna in Appendix I, 43 members voted in favor of the listing and 14 abstained (Blair, 2010).

The International Game Fish Association (IGFA) position statement explained:

Support for the proposal was weakened by lobbying from Japan and several Arab countries. Japan imports nearly 80% of Atlantic bluefin tuna harvested and publicly expressed before the final vote that it would not comply with a CITES listing, if passed. (IGFA, 2010)

In perhaps the most egregious example of hubris in politics, the Japanese "turned some heads by serving delegates bluefin tuna sushi at the Japanese embassy the night before the crucial vote on the ban" (Blair, 2010).

Thus, all of the influences of public policy are the result of one of the following logics: the logic of consequences or the logic of appropriateness. The logic of consequences is related to the ideal of the rational actor while the logic of appropriateness is related to the normative ideal. Mitchell (2009) wrote:

> The dominant understanding of why states behave as they do reflects a logic of consequences. With this logic, states behave as they do as a result of explicit, instrumental calculations of how the consequences of behaviors available to them will influence their interests. (p. 154)

In essence, they choose behaviors that are based on *what is best for me*. The alternative, logic of appropriateness assesses *what is the right thing to do*. This is a collision of public policy logics, which provides the basis of the opportunity to change the policies surrounding the Atlantic Bluefin Tuna. Greenberg (2010a) wrote:

> Some tuna advocates are coming to the conclusion that, as with whales, a different tack has to be taken, one that has more to do with the popular consumer mind-set than with science and policy. One that would ask consumers to evaluate all of the negatives of bluefin tuna and end the fish's plight by choosing not to eat it. (p. 220)

Both the persistent pattern of fisheries policies making and the policies themselves, are troubling. Science has identified the problems and solutions, yet these factors have consistently been ignored as ineffective policies have been made in an attempt to solve the problem or stop the continued decline. The burden of establishing the policies to reverse the decline rests with

the policymakers at multiple levels in many countries. McGoodwin (1990) wrote, "Successful regulatory regimes must always be fitted to the particular type of fishery they seek to manage and must always employ a mixture of strategies" (p. 180).

If all of the stakeholders in the Atlantic Bluefin Tuna debate decide to maintain the status quo and not implement further conservation measures, there is almost certainty that the species will collapse within a very few years. The World Wildlife Fund predicted that time would be 2012, but we now know that did not occur. However, the size of the stock continues to be overfished and the size of the breeder population continues to decline.

What are the consequences to a collapsed Atlantic Bluefin Tuna fishery? Perhaps there would be no consequences perceptible to humans in the short term. With the loss of the bluefin tuna, it is very probable that we would just move on to the next most desirable species for food. However, the consequences to the marine ecosystem would certainly realize the loss of the bluefin tuna as an apex predator. Repairing the world's fisheries does not have to involve draconian solutions; it does, however, involve responsibility by all parties. Scientists and fisheries managers have the knowledge to repair and restore the fisheries. Examples of restoral successes include Chesapeake Blue Crab (*Callinectes sapidus*) and the North American Swordfish (*Xiphias gladius*).

Historically, the Chesapeake Bay was one of the most prolific fishing grounds in the world, especially for oysters and crabs. Entire communities of Virginia and Maryland were built on the backs of the blue crab. Warner (1976) wrote, "It comes as a surprise, therefore, to learn that the Chesapeake has provided more crabs for human consumption than any body of water in the world, great oceans included" (p. xii). The Chesapeake Blue Crab, also known as *the beautiful swimmer*, became severely overfished after countless years of harvest. The stocks had

reached such low levels that in 2008, the U.S. Department of Commerce declared the fishery a federal disaster area. At the same time, the states of Maryland and Virginia, in conjunction with the Potomac River Fisheries Commission, set out to reduce harvest pressure. Catch limits, catch methods, seasonally-closed areas, and the elimination of winter dredging of the bay were implemented. Those who made their living, namely the crabbers, largely resisted the rebuilding measures. In 2012, after 4 short years of the plan, the blue crab population in the Chesapeake Bay is at its highest level since 1993. In April 2012, Governor Bob McDonnell of Virginia said:

> This is fantastic news. The crab population is the highest it has been in the past 20 years, and to see this record production of juveniles is truly remarkable. Those crabs will grow over the summer and many will reach market size in the fall. Those that aren't harvested and brought to the dinner table will become the building blocks for future generations of crabs. ("Governors Bob McDonnell," 2012, para. 4)

Krikstan (2009) reported:

> After more than a decade of population decline, a winter dredge survey conducted last year, after the moratorium, measured a significant jump in the number of blue crabs wintering in the southern portion of the bay, from 280 million in 2007-2008 to just over 400 million. (para. 8)

Clearly, the implemented conservation measures are having a positive effect in a relatively short period of time.

The swordfish is an apex predator that is a highly migratory species and lives, in part, in the same waters as the Atlantic Bluefin Tuna. Like the bluefin tuna, it has spawning site fidelity and is highly fecund; however, it can spawn year round. A single mature female can produce 30 million eggs. The fish stocks are managed in the waters of the United States by NMFS and

internationally by ICCAT. The flesh of the swordfish is highly desirable because of its taste and appearance and it is considered to be one of the greatest gamefish. In 1957, Marron wrote:

> To the oldest fishing pros and to the smartest fishing amateurs, albacora, the broadbill swordfish, is the prize of all prizes. Hooking and catching an albacora is an art set apart. It is the most involved, complex and intricate feat in the whole great sport of fishing. (p. 43)

Aside from sport, the desire for swordfish flesh drove vigorous commercial fishing activity, in particular long lining. In the 1990s, the species became overfished with the stock reaching a low 65% of the number required to maintain maximum sustainable yield (MSY) (ICCAT, 2009d). At the time, it was apparent that without action the stock would collapse completely. When some well-known chefs became aware of the dire situation, they boycotted swordfish. Brownstein, Lee, and Safina (2003) wrote:

> Seaweb and the Natural Resources Defense Council [both nonprofit conservation groups] recruited top east coast chefs like Rick Moonen, now of RM Restaurant [New York], and Nora Pouillon, from Restaurant Nora [Washington, DC] to help launch a campaign called 'Give Swordfish a Break.' Over 700 chefs boycotted swordfish until the commission cut catch quotas. (para. 3)

In 1999, ICCAT implemented a 10-year plan to rebuild the swordfish stocks which included the following steps: time area closures, minimum catch size, bait restrictions, gear restrictions, and mandatory vessel monitoring systems. Although a minimum size limit had been implemented, there was no apparent recovery. Also, in 1999 NMFS instituted two permanent area closures to protect juveniles in the waters of the United States. In August 2000, NMFS closed 132,670 square miles in areas of the Gulf of Mexico and off of the East Coast of Florida

to long line fishing (Pickrell, 2002). The results of these actions were no less than spectacular because by 2002 the species was considered to be in recovery and by 2009 the stocks were considered to be rebuilt (Pew Environmental Group, 2010, p. 1). SeaWeb (2012) reported, "The campaign ended successfully in August 2000 when the U.S. government closed nursery areas in U.S. waters and the ICCAT implemented international quota restrictions and announced that North Atlantic swordfish had reached 94% of health levels" (para. 5). In spite of the evidence of recovery, some question whether there was a decline in the first place. Linda Greenlaw, a commercial fisher wrote, "As far as I was concerned, all science surrounding swordfish is brittle" (Greenlaw, 2010, p. 115). Today, the North American Swordfish is vibrant and self-sustaining because of the measures that were implemented to restore the stocks.

These are two examples of management measures that have been undertaken on behalf of desirable species. The results clearly show positive results of rebuilding and rebuilt stocks. Perhaps the same types of measures adopted to save the swordfish should be used to save the Atlantic Bluefin Tuna because of the similarities of habitat and behavior. Further, the example of the swordfish proves that an international treaty action can be effective. Other more restrictive options are available to restore a marine species such as the Endangered Species Act (ESA) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), also known as the Washington Convention and the Endangered Species Act. Safina (1998) stated that the rebound of the Gray Whale (*Eschrichtius robustus*) was "one of the most spectacular successes of the Endangered Species Act and CITES" (p. 164).

The Atlantic Bluefin Tuna could be subject to both an ESA listing and an Appendix I CITES listing. Listing the species under the ESA in the United States would have a negative effect under the current fishery management situation because if taking of the fish were banned

in U.S. waters, ICCAT could simply re-allocate the U.S. quota to other countries. An Appendix I listing under CITES would have a positive effect on the species, however, the political reality of passage in the current international environment is not realistic.

The fisheries of the world are a common resource and should be managed for the benefit of all peoples, not just for the select few. The only real hope for new fisheries policies in the global community is as Klein and Marmor (2008) stated that the "previously unthinkable has become doable" because of a cataclysmic drop in quantities of fish below the point of sustainability. This is an issue that is *cross-national* that must be addressed by the global community.

The issues surrounding fisheries policy are complex, possess scientific realities, and contain basic analytical points; however, the scientific method does not speak to the more complex ethical and hermeneutic interpretations of the consequences of depleting fisheries. The policies have been analyzed, they have been deconstructed, they have been measured, and they have been intellectually scrutinized. The time has come to put all of it together and take decisive action. In a final report prepared by the U.S. Commission on Ocean Policy (2004), the Chairman, Admiral James D. Watkins, wrote, "The urgent need for action is clear. It is equally clear that, by rising to the challenge today and addressing the many activities that are affecting our continent at its edges, our nation can protect the ocean environment. . . ." (p. 6). This is not a policy issue that will consume the political landscape, as has healthcare, until one day widespread hunger begins to grip areas of the world that have never experienced real hunger because a primary source of protein will no longer be available. By that time, it will be too late because the fisheries will have gone beyond the tipping point and some could have fallen into the abyss of collapse.

Today, there are three options that define future course of action. First, do nothing. The consequences of not changing policies, including hunger, starvation, irrevocable damage to the planet, and fisheries collapse loom largely. Second, prepare for these consequences by seeking new sources of protein for millions of people. Further, prepare for the consequences of collapsing ecosystems. Or, third, reduce the strain on the fisheries through new public policies that are forward looking, intuitive, and imaginative in their approach, evaluation, design, and implementation**.** Lane (1976) wrote, "The basic need for conservation and coherent international management of tuna and other fisheries should override national interests. Cooperation to that end constitutes a major international fisheries challenge" (p. 36).

This dissertation answers the question: What public policies should be established to save the Atlantic Bluefin Tuna?

The 10 Public Policy Steps to Save the Atlantic Bluefin Tuna

Saving the Atlantic Bluefin Tuna from collapse will require a unified full-ocean and all-country management strategy because the oceans and the fisheries are, and function as, an intertwined complex system. The following 10 steps should be implemented immediately.

Create a Permanent Atlantic Bluefin Tuna Sanctuary in the Spawning Areas of the Mediterranean Sea and Gulf of Mexico

Marine sanctuaries are areas that are set aside to ensure that all marine life and their habitat are fully protected. Further, they are declared off limits to fishing activity. Marine sanctuaries can be declared by national governments such as Australia's Great Barrier Reef and the U.S. Virgin Islands National Park. Further, they can be established by international treaty such as the Pelagos Sanctuary for Mediterranean Mammals and the proposed Ross Sea Treaty in

Antarctica. Marine sanctuaries have been successful as evidenced by the return of fish and fauna.

One of the first marine sanctuaries, the Flower Garden National Marine Sanctuary in the Gulf of Mexico, brought together a group of interested parties: NOAA, the Environmental Protection Agency (EPA), U.S. Coast Guards (USCG), the oil and gas industry, academic institutions, divers organizations, diving operators, public school teachers, and environmental groups (Ray, n/d, p. 1). The Flower Garden Banks were given that name by commercial fishers because of all of the multicolored corals and sponges that appeared in their nests and lines when retrieved. They are located 110 miles southeast of Galveston, TX and are over approximately 42-square nautical miles (p. 3). Ray (n/d) wrote:

> The bottom line is a success story for the cooperative efforts of government regulators, industry, and the public. The many years of monitoring studies have verified that the protective measures put in place for the marine sanctuaries were appropriate and worked! The reefs are healthy, viable, and have shown no contamination or degradation due to the nearby oil and gas activities. The public has a unique marine habitat, which is protected and available for future generations to enjoy. The industry has been able to continue exploring, developing, and delivering important energy resources to the country. This is a success story, which spans many years, and that the many participants can be proud of. (p. 6)

This is one of perhaps hundreds of marine sanctuary success stories in the world.

The Atlantic Bluefin Tuna spawning areas in the Gulf of Mexico and in the Mediterranean should be protected as marine sanctuaries. Regularly these areas experience intense commercial fishing activity from long liners and purse seiners. In both cases, Atlantic Bluefin Tuna, especially spawning females and under-sized and immature fish, are taken as both targeted species and bycatch. Further, this action would assist with the elimination of bycatch of marlin, sailfish, and turtles in this area. Spawning area sanctuaries are common conservation tools employed by fishery management organizations. They have met with success as evidenced

by numerous examples such as the East End Scallop (Atlantic sea scallop [*Placopecten magellanicus*]) and the North American Swordfish.

In the *Report of the Independent Review* of ICCAT, the review panel wrote, "The Panel further recommends that ICCAT consider an immediate closure of all known Bluefin tuna spawning grounds at least during known spawning periods" (Hurry et al., 2008, p. 62). The ICCAT signatory countries should come together to immediately and permanently declare those areas of the Gulf of Mexico and Mediterranean Sea as the Atlantic Bluefin Tuna Spawning Area Marine Sanctuaries.

Impose a 10-Year Moratorium on all Landings for Atlantic Bluefin Tuna

A fishing moratorium is the suspension of fishing activity for a period of time. A moratorium can be temporary, defined by a particular time frame, or permanent. The main purpose of moratoriums is to allow for a particular species' biomass to rebuild or increase without outside or artificial removals from the ecosystem. Fishing moratoriums can cause economic hardships on those who depend on a particular fishery for income. For example, the moratorium imposed by the Canadian government after the cod stocks collapsed in 1993. Moratoriums are effective tools available to fishery management organizations.

The Striped Bass (*Morone saxatilis*) fishing moratorium in the Chesapeake Bay is an example of a fishery moratorium success. The species, also known as Striper and Rockfish, is one of the most pursued of all coastal sport fish. Striped Bass are native to most of the East Coast of the United States. The species adapts easily to fresh water environments and as a result, because of stocking programs in lakes and reservoirs, it is found in 31 states. It has been a desirable fish since colonial times. The species was overfished and in the 1980s the fishery collapsed. In response to the collapse, the states of Maryland and Delaware imposed a

moratorium on striped bass fishing in 1985. The Commonwealth of Virginia and Potomac River Fisheries Commissions followed this action by declaring a moratorium. The moratorium was lifted in 1990 because of the stock's rebuilding success. Krikstan (2009) noted, "Restrictions placed on the striped bass harvest, including a 1984 Maryland moratorium, allowed the population to rebound to what is today considered sustainable numbers" (para. 12). Today, the Striped Bass stock has been rebuilt and is maintained by monitoring, quotas, and seasonal closings.

In the case of the Atlantic Bluefin Tuna, it is clear and accepted by ICCAT that the stocks are below 15% of the historical baseline of the species (ICCAT, 2009c, p. 81). The species has reached a point where it is fully qualified to be included in Appendix I of CITES, however, certain countries because of greed and special interest group motivation blocked this action.

In spite of all the recovery plans that have been implemented, the stocks continue to decline. An independent review panel commissioned by ICCAT found the collapse of the Atlantic Bluefin Tuna was a "real possibility" and "CPCs of ICCAT have failed to abide by their legal obligations under international law, have failed to conserve Bluefin tuna, and have failed in the eyes of the international community" (Hurry et al., 2008, p. 62). Further, the international review committee recommended in their report:

> All fishing for East Atlantic and Mediterranean Bluefin tuna be immediately suspended . . . .The panel considers that this decision is the only way to stop the continuation of what is seen by observers and other CPCs as a travesty in fisheries management. (Hurry et al., 2008, p. 62)

Implementation of a 10-year moratorium strategy would apply to both the commercial and recreational fisheries. Ten years would allow the Atlantic Bluefin Tuna to become a recovering

breed because it would allow multiple generations to reproduce. The Atlantic Bluefin Tuna is a highly fecund species; females produce 128.5 eggs per gram of body weight, and some females produce up to 75 million eggs (Pepperell, 2001, p. 86). Bluefin tuna larvae have a high mortality rate with 99% lost after the first year. The surviving 1%, 15,000-75,000, per female per year would have the opportunity to mature and reproduce to rebuild the stocks.

The ICCAT signatory countries should come together to immediately declare a 10-year moratorium on all takings of Atlantic Bluefin Tuna worldwide, including levying stiff penalties for violations, addressing bycatch, including no discards at sea, and tag-and-release only for recreational anglers.

When Moratorium Ends, Establish Quotas at 50% of Present Day Quotas for 10 Years

After the 10-year moratorium on taking all Atlantic Bluefin Tunas, the fisheries could be reopened to fishing activity. However, catch quotas should be set at 50% of present day quotas for a period of 10 years. This would allow the stocks to continue to rebuild without a threat of overharvest. It would be essential that improved reporting and monitoring through electronic vessel monitoring systems be implemented by ICCAT to ensure compliance.

Close the Entire Gulf of Mexico and Mediterranean Sea to all Purse Seine Fishing for 20 Years During the Atlantic Bluefin Tuna Spawning Season

Purse seine fishing is a desirable method of catch for commercial fishers. It involves surrounding a school of fish with a net and drawing it shut, like a woman's purse. It is an efficient technique that has been used for many decades. Perhaps the leading drawback of purse seining is bycatch, those nontargeted species that are trapped in the net during a haul. Often bycatch is either injured beyond repair or already dead due to crushing or drowning when the nets are deposited on the vessels' decks.

All purse seine fishing activity should be banned during the Atlantic Bluefin Tuna spawning season in the Gulf of Mexico (April through June), and the Mediterranean Sea (June through August) (Froese & Pauly, 2010). This would allow safe passage to mature females and immature and smaller fish in the migration. It would eliminate the possibility of the breeding stock to become bycatch and removal from the biomass.

Base Atlantic Bluefin Tuna Policy on Science

A common sense approach, guided and based on science, especially fishery-independent stock assessment, should be adopted in making all fisheries policies. Science provides a basis for understanding the changes that occur in an environment and understanding how ecosystems function. Further, science is valuable for predicting how changing conditions might affect how a particular ecosystem functions. Science cannot, however, provide a path to satisfy human goals and desires. Sullivan et al. (2006) wrote:

> A common misconception of nonscientists is that science can provide objective answers to the thorny question, 'How *should* we manage this ecosystem or resource?' Such questions can be answered only by reconciling the socially constructed values and expectations of the stakeholders at the policymaking table. (p. 4)

For the Atlantic Bluefin Tuna, a cooperative research should be fostered on all phases of the fishery and policymakers should not allow fish take limits to be set above the levels that are biologically safe. Legitimate disagreements that occur among different scientists should not be confused with imprecise data because it is confusing to the public debate. Ultimately, all parties concerned should not be afraid of the data even if does not support their perspective because the long-term goal of any fishery management scheme or organization should be long-term sustainability of the self-renewing resource being managed.

Restructure, Reorganize, and Empower ICCAT

Currently, ICAAT is an organization where decision making is difficult. The difficulty in decision making often supports its reputation of inaction and makes the organization appear to be a "paper tiger." At the root of the problem is the manner in which the organization makes decisions. Roberts (2012) wrote:

> International forums are usually constituted on an egalitarian basis, where every nation has an equal vote and decisions are made by consensus. If unanimity cannot be achieved, the measure fails. This setup gives excessive power to minorities and allows essential measures to manage the environment to be hijacked by self-interested groups. . . Therefore, a procedural shift to majority vote from consensus should be made. (p. 327)

The politicians selected by the signatory countries to be ICCAT representatives must act responsibly in their decision making and base their decisions on the best available science. This is difficult because the fishing industry IS the delegation and they are unwilling to make the hard choices to ensure a plentiful tomorrow. ICCAT, as an organization should have the political will to force industry to abide by the rules as they design them; reduce the number of fishing vessels in the fleet; flag fishing vessels; eliminate illegal, IUU fishing; design proper reporting methods; and establish enforcement powers.

Move Away From Single Species Management Towards an Integrated Multispecies (Predator-Prey)-Based Approach or Ecosystem Management

One of the theoretical bases of this dissertation was complexity theory, described by Mikulecky (2001) as, "The nature of the real world demands more than traditional science can deliver. Complexity science. . .demands that the barriers and constraints be removed in order to

gain a more complete view of nature" (p. 341). The complex nature of the problems surrounding the fisheries cannot be fitted into the neat and confined boxes of individual problems and individual solutions, which would only provide partial solutions. Botsford et al. (1997) wrote:

> A holistic, ecosystem approach to fishery management requires the integration of information from a wide range of disciplines, levels of ecological organization, and temporal and spatial scales. New, expanded mathematical models that synthesize multiple processes are critical to the scientific basis of ecosystem management of marine fisheries. Such modeling should integrate the many anthropogenic influences on ocean ecosystems, now treated in isolation: eutrophication and induction of nuisance algal blooms; habitat destruction, fragmentation, and degradation; species introductions, extinctions, and endangerments; chemical pollution of the sea; and effects of anthropogenic and natural global change on ocean physics. (p. 514)

This would be a very dynamic approach where all species would be considered in any management action. If this was not already under consideration, then why does currently ICCAT manage other species that are not tunas? Palumbi (2002) is quoted in an article in *Environmental News Service* in which he states, "Unless we fundamentally change the way we manage all the oceans species together, as working ecosystems, then this century is the last century of wild seafood" (para. 7).

Regulate the Buyer

The flesh of the Atlantic Bluefin Tuna has become so valuable that regulation will have to go beyond catch limits and moratoriums. Willson and Canet (2010) claim, that in the past 12 years, it is estimated there has been in excess of $4-billion in illegal trade of Atlantic Bluefin Tuna flesh (para. 8). Further, they claim the entire supply chain is replete with falsified records

and dishonesty. A 2012 an independently reviewed scientific analysis (The Pew Environmental Group) revealed that as much as half of the Atlantic Bluefin Tuna catches were illegal. In part, the report stated:

> The 2012 study estimates that total allowable quotas were exceeded by 62 percent between 2005 and 2011 and by 77 percent between 2008 and 2011, confirming previous reports of persistent and widespread illegal fishing in the BFTE fishery. This means that catch exceeded the quota by approximately 112,000 metric tons [mt] during the seven-year study period. Further, the gap between actual catch and the quotas is likely to be even higher due to black market trade and several other factors not captured in official records. (p. 1)

Collette et al. (2011) wrote:

> Per kilogram, bluefin species are among the most expensive fresh seafood in the world and can reach extreme values in global markets. Their high value makes them likely to be exploited far beyond the maximum sustainable yield [MSY, the largest catch that can be taken from a species' stock over an indefinite period], and in danger of an anthropogenic Allee effect [low population densities lead to reduction of reproductive success and increased possibility of collapse]. (p. 292)

Recently, the United States unilaterally established the Billfish Act of 2012 (HR 2706), signed into law on October 5, 2012 by President Barack Obama. This new law prohibits the importation and sale of billfish in the domestic United States. Further, the law makes it illegal for any business to possess billfish meat, effectively eliminating the market for the fish. The United States had been the largest importer of billfish meat in the world. This law will allow the

stocks of marlin, sailfish, and spearfish to recover. The law does not cover swordfish, as they are not considered to be a billfish.

A similar measure making the sale and possession of Atlantic Bluefin Tuna flesh should be adopted internationally in conjunction with the recommended 10-year moratorium on taking of Atlantic Bluefin Tuna.

The Immediate Establishment of a Conservation Quota

Currently, if a country takes unilateral action to prevent the taking of Atlantic Bluefin Tuna, or if a country does not catch its quota, it is subject to losing the unused portion, and it is then distributed to other countries. Effective immediately, ICCAT should establish a *conservation set-aside* or *conservation quota* where a responsible country will not lose the allowable catch quota. For example, if the United States' quota for a particular year were 520 mt and NMFS decided to close the Atlantic Bluefin Tuna fishery after 300 mt were harvested, the United States would retain the remaining 220 mt quota. Quota lost to another country does not help with stock renewal or replenishment.

Revise Stock Measurement Methods

A first move should be to stop using MSY as a measure. By the late 1800s, fishermen and scientists realized that there were periodic fluctuations in fishery populations. In the 1890s, Hold suggested that taking spawning fish out of their ecosystem was a major cause of overfishing (cited in Weber, 2002, p. 13). In the early 1950s, fishery management was revolutionized when the concept of MSY was developed and adopted. Weber (2002) wrote, "Drawing on the work of Milner Schaefer at the Bureau of Commercial Fisheries and Michael Graham in Britain, William Herrington, a biologist in the State Department, successfully promoted adoption of MSY as the standard for U.S. fisheries management" (p. 13). Further,

Weber wrote, "MSY was defined as the largest animal catch or yield in terms of weight of fish caught by both commercial and recreational fishermen that could be taken continuously from a population of fish under existing environmental conditions" (p. 13).

In 1997, Holt, one of the developers of the MSY concept, realized that by continuing to remove fish at a level amount at or above MSY "[the] population would be driven toward extinction at an accelerating pace" (cited in Weber, 2002, p. 14). McGoodwin (1990) wrote:

> Managing for MSY would avoid disastrous resource declines in most open-access fisheries, but any modern fishery managed solely for this objective would almost inevitably become over-developed, and then its fishers would suffer all the associated ills: excessive capital costs, intense competition, declining yields per unit of effort, and utter dissipation of the economic rent in the fishery. (p. 149)

There have been some Managed Species Successes/MSY successes. However, MSY should be replaced with the concept of *maximum economic yield*, where everything that is caught, such as bycatch, has a value and is not merely discarded.

Final Thoughts

As this dissertation was being finalized in preparation for defense, the November 2012 ICCAT meeting was underway. The commission adopted positive measures surrounding Atlantic Bluefin Tuna. Susan Lieberman, Director of International Policy for the Pew Environment Group said:

> While we're pleased that ICCAT supported efforts to help rebuild bluefin tuna populations, it's regrettable that the commission couldn't achieve consensus on immediate protective measures for sharks. . . While there was progress toward putting in place an electronic system to track bluefin tuna, it is disappointing that ICCAT only made

> limited progress in overall efforts to stop illegal fishing. (cited in Bard, Benn, & Samari, 2012, para. 2)

ICCAT members took important steps to eliminate IUU fishing by adopting a policy for port inspections. Now, all vessels will be required to provide information about their catch before entering a port, and governments will have certain minimum requirements to inspect those vessels in port. However, the governments cannot be compelled to enforcement action if illegal catches are found. Perhaps, it is a good first step or perhaps it is the continuation of failed policies. Concerning the Atlantic Bluefin Tuna, ICCAT took unprecedented action by following scientific advice and Bluefin Tuna quotas were not raised. This is an indication the organization has decided to begin basing decisions on the best available science. Next steps in understanding Bluefin Tuna management policy would be further study in understanding biological details of the species, including stock status, and investigation applying innovations and new methods using complexity theory to this fishery management case.

Ultimately, saving the Atlantic Bluefin Tuna will require unity in responsibility; taking ownership of the problem; leadership; and a series of steps endorsed, adopted, and implemented by all interested parties. All of the laws, regulations, and polices can be formulated and adopted; however, if they are not enforced properly they will not be effective. Human responsibility is the solution of all of the Earth's problems and human behaviors. Human responsibility cannot be legislated, only enforced. All the science does not create it because as Safina (1998) wrote, "Responsibility, it appears, is beyond the realm of science" (p. 94). Responsibility must come from within human beings to ensure a healthy world forever.

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APPENDIX A

PERMISSION FROM ARTIST TO USE DRAWING IN FIGURE 7 IN TEXT

AGREEMENT

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List of Illustrations:
Atlantic Bluefin Tuna, *Thunnus thynnus*

V. Kells

Signed: Val Kells_____ Date 11-22-12

Signed: Tim O'Brien_____ Date 10.25.2012

APPENDIX B. BFT-Table-ESTIMATED CATCHES OF NORTHERN BFT BY AREA, GEAR, AND FLAG

(Adapted from the *Report of the Standing Committee on Research and Statistics* (PLE-104/2012), ICCAT, p. 87-89.)

BFT-Table 1. Estimated catches (t) of Northern bluefin tuna (*Thunnus thynnus*) by area, gear and flag.

			1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
TOTAL			20723	27016	23819	26027	29350	34131	36636	48853	49714	53320	49489	42375	35228	36541	37390	37089	33469	33505	37602	32501	36154	25849	21730	13186	11765
BFT-E			18220	24118	21061	23247	26429	31849	34268	46740	47291	50807	47155	39718	32456	33766	34605	33770	31163	31381	35845	30689	34516	23849	19751	11328	9779
	ATE		4456	6951	5433	6040	6556	7619	9367	6930	9650	12663	13539	11376	9628	10528	10086	10347	7362	7410	9036	7535	8037	7645	6684	4379	3989
	MED		13764	17167	15628	17207	19872	24230	24901	39810	37640	38144	33616	28342	22828	23238	24519	23424	23801	23971	26810	23154	26479	16205	13066	6949	5790
BFT-W			2503	2898	2759	2780	2921	2282	2368	2113	2423	2514	2334	2657	2772	2775	2784	3319	2306	2125	1756	1811	1638	2000	1980	1857	1986
Landings	ATE	Bait boat	1821	1936	1971	1693	1445	1141	3447	1980	2601	4985	3521	2550	1492	1822	2275	2567	1371	1790	2018	1116	2032	1794	1260	725	567
		Longline	924	1169	962	1496	3197	3817	2717	2176	4392	4788	4534	4300	4020	3736	3303	2896	2750	2074	2713	2448	1706	2491	1960	1194	1157
		Other surf.	668	1221	1020	562	347	834	1548	932	1047	646	511	621	498	703	712	701	560	402	1014	1047	502	187	298	143	36
		Purse seine	0	0	0	54	46	462	24	213	458	323	828	692	726	1147	150	884	490	1078	871	332	0	0	0	1	
		Sport (HL+RR)	3	1	2	1	0	0	0	0	0	0	162	28	33	126	61	63	109	87	11	4	10	6	2	25	92
		Traps	1040	2624	1478	2234	1522	1365	1631	1630	1152	1921	3982	3185	2859	2996	3585	3235	2082	1978	2408	2588	3788	3166	3164	2292	2137
	MED	Bait boat	0	0	0	25	148	158	48	0	206	5	4	11	4	0	0	1	9	17	5	0	0	0	0	0	
		Longline	799	1227	1121	1026	2869	2599	2342	7048	8475	8171	5672	2749	2463	3317	3750	2614	2476	2564	3101	2202	2656	2254	1213	1058	869
		Other surf.	2762	2870	3289	1212	1401	1894	1607	3218	1043	1197	1037	1880	2976	1067	1096	990	2536	1106	480	301	699	1022	169	275	223
		Purse seine	8857	11198	9450	11250	13245	17807	19297	26083	23588	26021	24178	21291	14910	16195	17174	17656	17167	18785	22475	20020	22952	12641	11395	4984	4293
		Sport (HL+RR)	433	838	457	1552	738	951	1237	2257	3556	2149	2340	1336	1622	1921	1321	1647	1392	1340	634	503	78	137	146	351	226
		Traps	913	1034	1311	2142	1471	821	370	1204	772	601	385	1074	852	739	1177	515	221	159	115	129	95	152	144	281	165
	ATW	Longline	1138	1373	698	739	895	674	696	539	466	547	382	764	914	858	610	730	186	644	425	565	420	606	366	529	743
		Other surf.	156	425	755	536	578	509	406	307	384	432	293	342	281	284	202	108	140	97	89	85	63	82	121	107	148
		Purse seine	367	383	385	384	237	300	295	301	249	245	250	249	248	275	196	208	265	32	178	4	28	0	11	0	
		Sport (HL+RR)	726	601	786	1004	1083	586	854	804	1114	1029	1181	1108	1124	1120	1649	2035	1398	1139	924	1005	1023	1130	1251	1009	887
		Traps	17	14	1	2	0	1	29	79	72	90	59	68	44	16	16	28	84	32	8	3	4	23	23	39	26
Discards	MED	Purse seine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13
	ATW	Longline	99	102	119	115	128	211	88	83	138	167	155	123	160	222	105	211	232	181	131	149	100	159	207	174	181
		Other surf.	0	0	14	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Sport (HL+RR)	0	0	0	0	0	0	0	0	0	0	14	3	0	0	6	0	0	0	0	0	0	0	0	0	
Landings	ATE	Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		China P.R.	0	0	0	0	0	0	0	0	0	0	0	85	103	80	68	39	19	41	24	42	72	119	42	38	36
		Chinese Taipei	20	0	109	0	0	0	6	20	8	61	226	350	222	144	304	158	0	0	10	4	0	0	0	0	**0**
		EU.Denmark	0	1	0	0	0	0	37	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		EU.España	2479	4567	3565	3557	2272	2319	5078	3137	3819	6174	6201	3800	3360	3474	3633	4089	2138	2801	3102	2033	3276	2938	2409	1550	1488
		EU.France	533	724	460	510	565	894	1099	336	725	563	269	613	588	542	629	755	648	561	818	1218	629	253	366	228	135
		EU.Germany	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		EU.Greece	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		EU.Ireland	0	0	0	0	0	0	0	0	0	0	14	21	52	22	8	15	3	1	1	2	1	1	1	2	4
		EU.Poland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		EU.Portugal	163	48	3	27	117	38	25	240	35	199	712	323	411	441	404	186	61	27	79	97	29	36	53	58	180
		EU.Sweden	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		EU.United Kingdom	0	0	0	0	0	0	0	0	1	0	1	1	12	0	0	0	0	0	0	0	0	0	1	0	
		Faroe Islands	0	0	0	0	0	0	0	0	0	0	0	67	104	118	0	0	0	0	0	0	0	0	0	0	
		Guinée Conakry	0	0	0	0	0	0	0	330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Iceland	0	0	0	0	0	0	0	0	0	0	0	2	27	0	0	1	0	0	0	0	0	0	0	0	2
		Japan	900	1169	838	1464	2981	3350	2484	2075	3971	3341	2905	3195	2690	2895	2425	2536	2695	2015	2598	1896	1612	2351	1904	1155	1089
		Korea Rep.	0	0	0	0	0	0	0	4	205	92	203	0	0	6	1	0	0	3	0	1	0	0	0	0	
		Libya	0	0	0	0	0	312	0	0	0	576	477	511	450	487	0	0	0	0	0	47	0	0	0	0	**0**
		Maroc	356	437	451	408	531	562	415	720	678	1035	2068	2341	1591	2228	2497	2565	1797	1961	2405	2196	2418	1947	1909	1348	1055
		NEI (ETRO)	0	5	6	74	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		NEI (Flag related)	0	0	0	0	85	144	223	68	189	71	208	66	0	0	0	0	0	0	0	0	0	0	0	0	

	Norway	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	**0**
	Panama	4	0	0	0	0	0	0	1	19	550	255	0	13	0	0	0	0	0	0	0	0	0	0	0	
	Seychelles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	
	Sierra Leone	0	0	0	0	0	0	0	0	0	0	0	0	0	93	118	0	0	0	0	0	0	0	0	0	
	U.S.A.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
MED	Albania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	0	
	Algerie	420	677	820	782	800	1104	1097	1560	156	156	157	1947	2142	2330	2012	1710	1586	1208	1530	1038	1511	1311	0	0	
	China P.R.	0	0	0	0	0	0	0	97	137	93	49	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Chinese Taipei	0	0	0	0	0	0	328	709	494	411	278	106	27	169	329	508	445	51	267	5	0	0	0	0	**0**
	Croatia	0	0	0	0	1418	1076	1058	1410	1220	1360	1105	906	970	930	903	977	1139	828	1017	1022	825	834	619	389	371
	EU.Cyprus	10	10	10	10	10	10	14	10	10	10	10	21	31	61	85	91	79	105	149	110	1	132	2	3	10
	EU.España	1178	1428	1645	1822	1392	2165	2018	2741	4607	2588	2209	2000	2003	2772	2234	2215	2512	2353	2758	2689	2414	2465	1769	1056	942
	EU.France	4330	5780	4434	4713	4620	7376	6995	11843	9604	9171	8235	7122	6156	6794	6167	5832	5859	6471	8638	7663	10157	2670	3087	1754	805
	EU.Greece	156	159	182	201	175	447	439	886	1004	874	1217	286	248	622	361	438	422	389	318	255	285	350	373	224	172
	EU.Italy	4607	4201	4317	4110	3783	5005	5328	6882	7062	10006	9548	4059	3279	3845	4377	4628	4973	4686	4841	4695	4621	2234	2735	1053	1783
	EU.Malta	36	24	29	81	105	80	251	572	587	399	393	407	447	376	219	240	255	264	346	263	334	296	263	136	142
	EU.Portugal	0	0	0	0	278	320	183	428	446	274	37	54	76	61	64	0	2	0	0	11	0	0	0	0	
	Iceland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	0	0	**0**
	Israel	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Japan	280	258	127	172	85	123	793	536	813	765	185	361	381	136	152	390	316	638	378	556	466	80	18	0	**0**
	Korea Rep.	0	0	0	0	0	0	0	684	458	591	410	66	0	0	0	0	0	700	1145	26	276	335	102	0	
	Libya	300	300	84	328	370	425	635	1422	1540	812	552	820	745	1063	1941	638	752	1300	1091	1280	1358	1318	1082	645	**0**
	Maroc	116	140	295	1149	925	205	79	1092	1035	586	535	687	636	695	511	421	760	819	92	190	641	531	369	205	182
	NEI (Flag related)	0	0	0	0	0	0	0	427	639	171	1066	825	140	17	0	0	0	0	0	0	0	0	0	0	
	NEI (MED)	183	633	757	360	1799	1398	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	NEI (combined)	0	0	0	0	0	0	0	773	211	0	101	1030	1995	109	571	508	610	709	0	0	0	0	0	0	
	Panama	72	67	0	74	287	484	467	1499	1498	2850	236	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Serbia & Montenegro	0	0	0	0	0	0	0	0	2	4	0	0	0	4	0	0	0	0	0	0	0	0	0	0	
	Syria Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	41	0	34	
	Tunisie	456	624	661	406	1366	1195	2132	2773	1897	2393	2200	1745	2352	2184	2493	2528	791	2376	3249	2545	2622	2679	1932	1042	852
	Turkey	972	1343	1707	2059	2459	2817	3084	3466	4220	4616	5093	5899	1200	1070	2100	2300	3300	1075	990	806	918	879	665	409	519
	Yugoslavia Fed.	648	1523	560	940	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ATW	Argentina	2	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Brasil	2	0	2	1	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	
	Canada	83	393	619	438	485	443	459	392	576	597	503	595	576	549	524	604	557	537	600	733	491	575	530	505	474
	Chinese Taipei	4	0	20	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Cuba	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	74	11	19	27	19	0	0	0	0	
	EU.Poland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	EU.Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	EU.United Kingdom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	FR.St Pierre et Miquelon	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	1	10	5	0	4	3	2	8	0
	Japan	960	1109	468	550	688	512	581	427	387	436	322	691	365	492	506	575	57	470	265	376	277	492	162	353	578
	Korea Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	52	0	0	0	0	
	Mexico	0	0	0	0	0	0	0	4	0	19	2	8	14	29	10	12	22	9	10	14	7	7	10	14	14
	NEI (ETRO)	0	0	30	24	23	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	NEI (Flag related)	0	0	0	0	0	0	0	0	0	2	0	0	429	270	49	0	0	0	0	0	0	0	0	0	
	Norway	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Sta. Lucia	1	3	2	14	14	14	2	43	9	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Trinidad and Tobago	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

		U.S.A.	1352	1289	1483	1636	1582	1085	1237	1163	1311	1285	1334	1235	1213	1212	1583	1840	1426	899	717	468	758	764	1068	803	738
		UK.Bermuda	0	0	0	0	0	0	0	0	0	1	2	2	1	1	1	1	0	0	0	0	0	0	0	0	0
		Uruguay	0	2	0	0	1	0	1	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
Discards	MED	Albania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Croatia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
		Turkey	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
	ATW	Canada	0	0	14	0	0	0	0	0	0	0	6	16	11	46	13	37	14	15	0	2	0	1	3	25	36
		Japan	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Mexico	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		U.S.A.	99	102	119	115	128	211	88	83	138	171	155	110	149	176	98	174	218	167	131	147	100	158	204	150	145

Appendix C
The Atlantic Bluefin Tuna- Common Names

List of vernacular names used according to ICCAT and Fishbase (www.fishbase.org). (Some local names might not be included.)

Albania: Toni
Angola: Atum, Rabilha
Argentina: Atún aleta azul, Atún rojo
Brazil: Albacora-azul, Atum, Atum-azul, Atum verdadeiro, Rabilo
Bulgaria: Ton
Canada: Bluefin tuna, Thon rouge, Squid hound
Cape Verde: Atuarro, Atum-azul, Atum-de-direito, Atum-de-revés, Atum-rabil, Atum-rabilho, Rabão
Chile: Atún cimarrón, Atún de aleta azul
China: Cá chan, Thu
Chinese Tapei: Hay we
Colombia: Atún, Atún de aleta azul
Croatia: Tuna plava, Tunj
Cuba: Atún aleta azul
Denmark: Almindelig Tun, Atlantisk tun, Blåfinnet tun(fisk), Tun(fisk)
Dominican Rep.: Atun
Egypt: Tunna
Faeroe Is: Tunfiskur
Finland: Tonnikala
France: Thon rouge, Ton France, Auhopu
Germany: Atlantischer Thunfisch, Roter Thun, Thunfisch
Greece: Tónnos, Tonos
Iceland: Túnfiskur
Ireland: An tuinnín, Bluefin tuna
Israel: Tunna kehula
Italy: Tonno, Ton, Tonne, Tunnu, Tunina, Tunnachiula, Barilaro, Franzillottu
Japan: Kuromaguro
Korea: Cham-da-raeng-i
Lebanon: T'oûn ah'mar
Malta: Tonn, Tonnu, Tunnagg
Marshall Is: Boebo
Mexico: Atún aleta azul
Morocco: Thone
Netherlands: Tonijn
Norway: Thunfisk, Makrellshørje, Sjorje
Oman: Tunna
Peru: Atún de aleta azul
Poland: Ton, Tunczyk blekitnopletwy
Portugal: Atum, Atum rabil, Atum-rabilho, Mochama
Romania: Ton, Ton rosu

Russia: Siniy, Krasnyj/Sineperyj/Sinij/Solsheglazyj/Zoludoj/Vostochnyj tunets
Senegal: Waxandor
SerbiaMontenegro: tuna
South Africa: Bluefin tuna, Blouvin-tuna
Spain: Atún, Atún rojo, Golfàs, Tonyina
Sweden: Tonfisk, Röd tonfisk, Makrillstörje
Tunisia: Toun ahmar
Turkey: Orkinos, Orkinoz baligi, Ton baligi
Ukraine: Obyknovennyi tunets
United-Kingdom: Northern bluefin tuna, Bluefin tunny
Uruguay: Atún rojo, Aleta azul
United States: Bluefin tuna

Source: ICCAT Manual, page 93.

VITA

Timothy Patrick O'Brien is the son of Frank M. O'Brien, Jr. and Martha Ann O'Brien. He was born in Coral Gables, Florida. Tim earned a Bachelor of Arts in Political Science (*Summa cum laude*) from St. Edward's University, Austin, Texas in 2001 and a Masters in Public Affairs from the Lyndon B. Johnson School of Public Affairs at The University of Texas at Austin in 2005. Tim serves on the international committee of the International Game Fish Association. He has a grown son, Patrick. He lives in Charlottesville, Virginia with his wife, Anne.